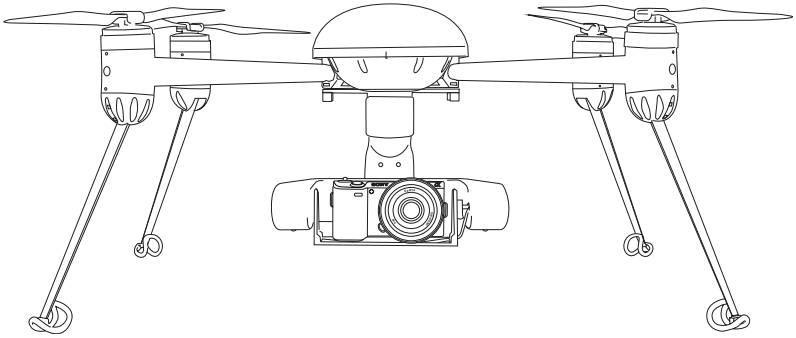
X4-ES USER MANUAL



Draganflyer X4-ES Helicopter

Version 2.1

draganFLY™
INNOVATIONS INC

Operator Notice

The responsibility to operate in a safe manner, prevent injury to persons or damage to property, and to take no unnecessary risks falls upon the owner and those whom the owner authorizes to pilot and operate the Draganflyer X4-ES helicopter.

Furthermore the onus is upon each owner/authorizer/pilot to comply with all regulations pertinent to the use of the Draganflyer X4-ES helicopter and associated components at the location of operation with regards to the use of airspace as well as radio communications.

Draganfly Innovations Inc. does not accept any responsibility for damages or financial compensations which may arise as the result of an owner/authorizer/pilot failing to comply with any regulations which would lead to a claim against the user.

Warning

The Draganflyer X4-ES helicopter is a precision machine that is vulnerable to misuse and can prove to be dangerous if not properly maintained or used in an inappropriate manor.

Special notice:

Throughout this manual, look for and pay special attention to these information boxes for tips, tricks, safety information, or serious warnings and risks, associated with this product.

Helicopters by their nature are not positively stable. Although the Draganflyer X4-ES can maintain an attitude and a position relative to wind movement without constant control input; operators should always be aware of its position and be able to take immediate control of the helicopter to recover from an unwanted position and avoid any mishaps. Please completely read and understand all Draganflyer X4-ES instructional information before attempting to fly the Draganflyer X4-ES.

To provide optimum performance, a Lithium Polymer battery powers your Draganflyer X4-ES. The same properties that make these batteries extremely powerful and lightweight also make them dangerous if handled incorrectly. Please read and understand all information pertaining to the battery before attempting to use or charge it.

IF MISUSED THIS AIRCRAFT IS CAPABLE OF CAUSING SERIOUS BODILY HARM TO THE OPERATOR AND SPECTATORS AS WELL AS PROPERTY DAMAGE. ANY DAMAGE OR INJURY OCCURRING DUE TO MISUSE OF THIS PRODUCT IS SOLELY THE OPERATOR'S RESPONSIBILITY.

DO NOT PLACE YOUR HANDS OR ARMS IN CLOSE PROXIMITY TO THE ROTORS OR ATTEMPT TO STOP SPINNING ROTORS WITH YOUR HANDS AS SERIOUS INJURY COULD RESULT FROM CONTACT.

THIS PRODUCT CONTAINS CHEMICALS WHICH ARE KNOWN BY THE STATE OF CALIFORNIA TO CAUSE CANCER, BIRTH DEFECTS AND/OR OTHER REPRODUCTIVE HARM.

Many common materials such as metals, plastics, glues, lubricants and other coatings contain chemicals in varying amount and concentrations which will cause harm if introduced into the human body. For further information on toxic or dangerous chemicals please refer to California's Health and Safety Codes Sections 25249.5-13

Special notice:

We are always shocked, and you might also find it hard to believe, that upon getting their new helicopter system many people want to take it apart to see how it works.

Often to their dismay, all they learn is the helicopter is as beautiful on the inside as it is on the outside but more times than not, they mix-up the motors or break something so our advice is please, just enjoy the helicopter, the amazing performance, and let your imagination soar with this incredible aerial tool.

- Understand there is no need to lubricate the motors and often people that don't listen to us and do it anyway, end up damaging them.

- Please also understand that each motor is coded to a specific position on the aircraft so don't get the wild idea to move a motor from the back up to the front. If you are experiencing a problem with the aircraft please just call our support line at 1-800-979-9794 or drop us an e-mail to support@draganfly.com.

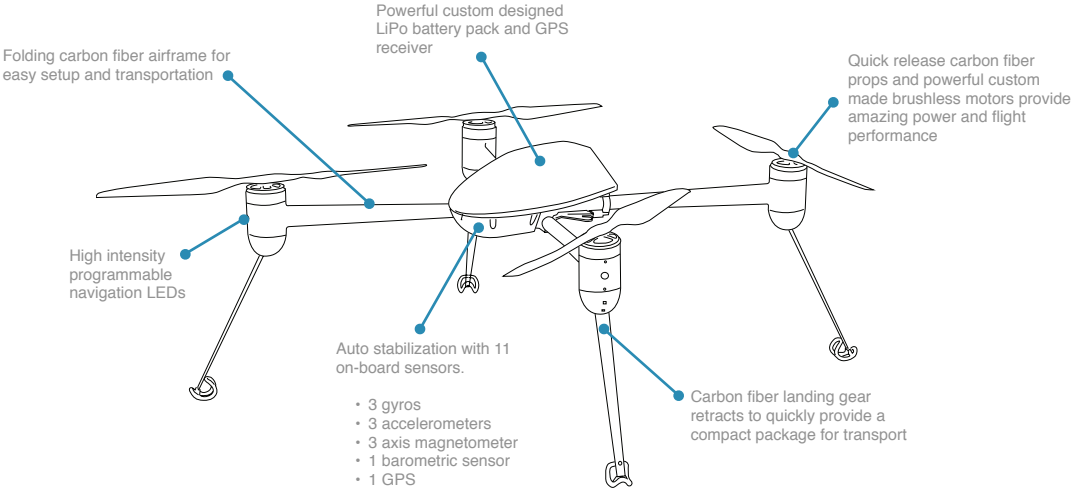
Safety Precautions

As the pilot in command you are responsible for the safety of yourself and others whether it be in the immediate takeoff and landing area, or the general flight path area. Please take safety very seriously.

- Always wear protective eyewear.
- Do not use batteries other than those specifically designed for the Draganflyer X4-ES; doing so may cause erratic flight performance and void the warranty.
- Do not fly the Draganflyer X4-ES in excessive winds.
- Do not fly the aircraft system in rain.
- Do not fly near people on the ground or objects in the air.
- Do not fly near pets or other animals.
- Do not fly near high-tension lines, electrical substations, high structures or communication facilities.
- Be careful where you place the controller and helicopter during flight preparations, be sure the equipment will not be dropped or suffer an accidental fall as this may cause serious damage.
- Never fly this aircraft where damage to property or injury to persons may result if loss of control occurs.
- Never leave the Draganflyer X4-ES unattended with the battery connected. Make it a habit to always disconnect the battery when not flying.
- When possible fly with a spotter or observer

Meet your Draganflyer X4-ES

Congratulations and thank you for purchasing the Draganflyer X4-ES helicopter system. Both you, and your new X4-ES helicopter will have many adventures together. We believe this amazing aerial tool will provide you with a new perspective in your work, and edge to your creativity. Here's a quick look at the helicopter:


Powerful custom designed LiPo battery pack and GPS receiver
Folding carbon fiber airframe for easy setup and transportation
Quick release carbon fiber props and powerful custom made brushless motors provide amazing power and flight performance
High intensity programmable navigation LEDs
Auto stabilization with 11 on-board sensors.
• 3 gyros
• 3 accelerometers
• 3 axis magnetometer
• 1 barometric sensor
• 1 GPS
Carbon fiber landing gear retracts to quickly provide a compact package for transport

Draganflyer X4-ES System

Contents

Chapter 1: Draganflyer X4-ES Setup

This is probably the most fun chapter of all. In this chapter you will unfold the frame, the landing gear, install the props, better understand the LiPo battery, discuss operating the aircraft safely, and get the helicopter ready for flight.

Chapter 2: Battery Safety and Charging

One of our more serious chapters but extremely important. Lithium Polymer (LiPo) battery technology has improved greatly over the years; but if not cared for properly, the batteries can be very dangerous.

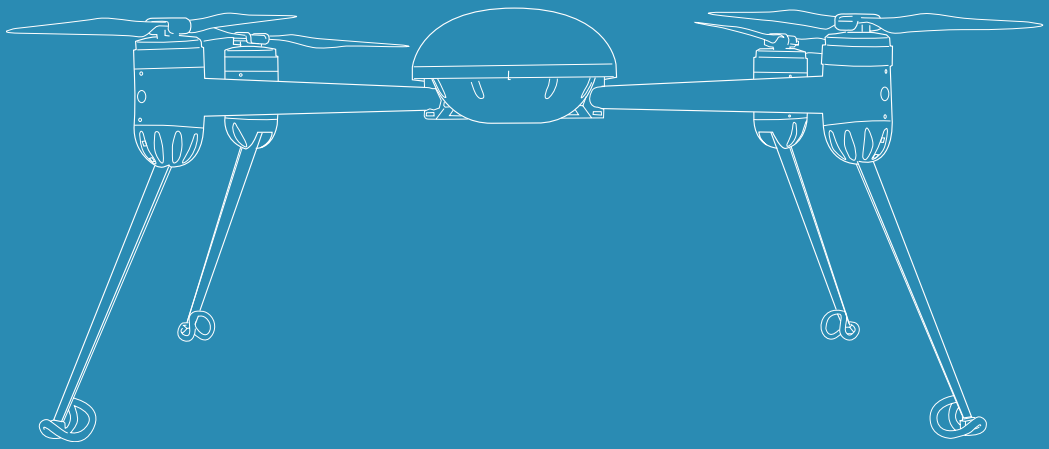
Chapter 3: Ready for flight

You have the helicopter fully assembled, batteries charged and you're excited to get it in the air, so now what? This chapter discusses some of the first flights and covers several flight training exercises.

Chapter 4: Aircraft technical data

Here you'll find all the specifications and technical data required to answer many of the questions asked by your agency responsible for the Air Space or the neighbor down the street.

Chapter 1

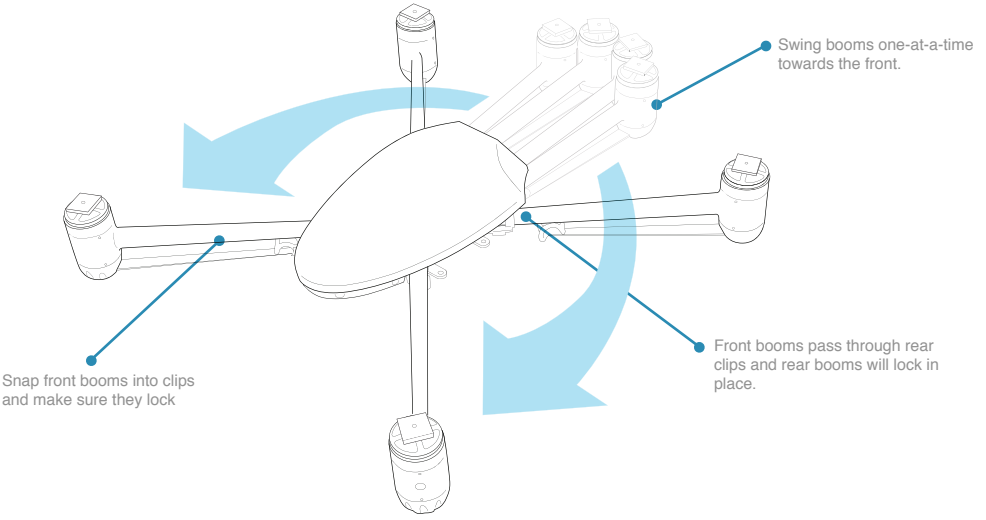


X4-ES Helicopter Setup

We had a great time building and flight testing your aircraft. In this section we'll go over the steps required to assemble the aircraft in preparation for launch. Because the aircraft can be equipped with several different payload packages, please refer to the individual payload manual for details about the payload set-up and how to get the most from it. To attach the various payloads is simple ... just twist and lock using the quick release system.

Extend helicopter booms

Start by unfolding the helicopter booms and snapping them into position. As they are unfolded, the front booms will "pass thru" the rear clips. Continue to bring the booms forward until firmly snapped in their front position. The rear booms will "lock" into the rear clips and with all four booms extended the frame is ready for the next step.


Swing booms one-at-a-time towards the front.
Front booms pass through rear clips and rear booms will lock in place.
Snap front booms into clips and make sure they lock

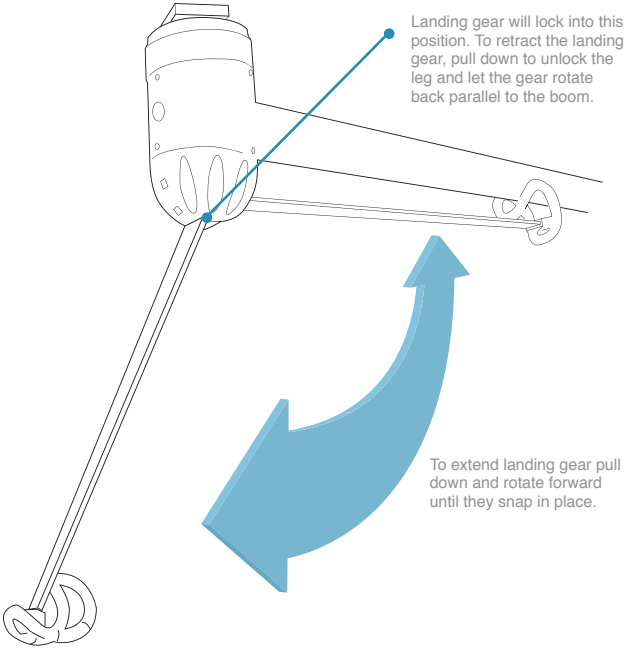
Extend Landing Gear

There are several helicopter systems on the market but we think you'll be hard pressed to find an aircraft where so much effort and design was involved to create a lightweight and incredibly strong airframe. In addition to it's strength, the airframe design allows the aircraft to quickly fold into a small package; light weight improves overall performance and folding, reduces transport case size making it easier to get out on scene or out working on that next project.

To extend the landing gear, simply pull them down and rotate forward until you feel and hear them snap into position. Double check and make sure they are locked and that's all that's required.

To retract the landing gear, pull down on the leg and allow the spring to rotate and pull the leg back parallel to the helicopter boom.

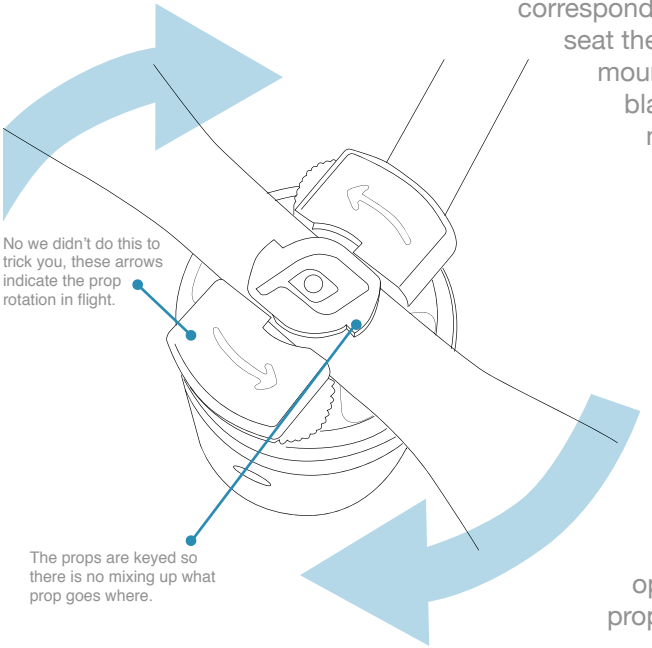
Fast, simple, lightweight, and very strong.


Landing gear will lock into this position. To retract the landing gear, pull down to unlock the leg and let the gear rotate back parallel to the boom.
To extend landing gear pull down and rotate forward until they snap in place.

Install Rotor Blades

We put some effort into making this a simple, fast process, to best ensure the correct prop gets on the correct motor. Your helicopter flies with two props spinning in a clockwise (CW) direction, and two spinning in a counter clockwise direction (CCW).

To get you started we color coded the props and mounts but we didn't stop there. The props have a keyed locking ring so only a CCW prop can be installed in a CCW mount, and we even included arrows on the mount to indicate the direction of prop rotation for that given motor.


No we didn't do this to trick you, these arrows indicate the prop rotation in flight.
The props are keyed so there is no mixing up what prop goes where.

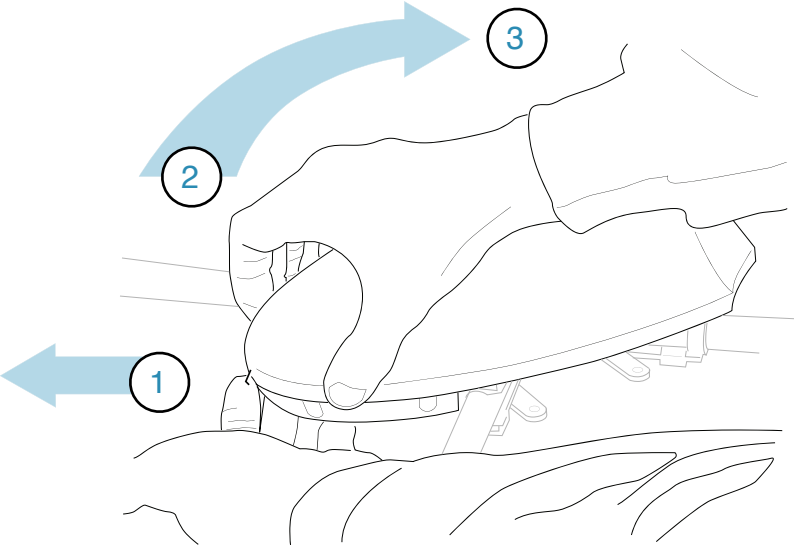
To install the rotor blades, place the prop on the corresponding rotor mount, press down to seat the prop and while holding the mount, rotate the prop ¼ turn until the blade clicks into place. To help make this a little easier, there is a nice serrated thumb grip to help latch and unlatch the props.

Please install all four props on the helicopter and give them a good spin once they are seated.

When you have completed your work and it's time to pack up the system, gently push down on the locking tabs of the rotor mount and twist in the opposite direction to unlock each prop.

Remove Canopy

You really want to do this right or you can damage the canopy. The canopy removal process is as simple as 1, 2, 3. Position your hands as shown. Using one finger pull the latch pin forward, then start to lift using the carbon fibre tabs, and rotate the canopy while sliding it back and off the aircraft.

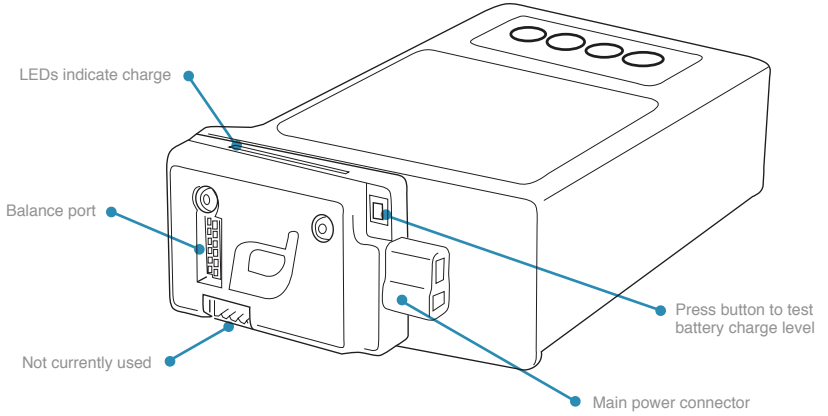


Canopy removal is as simple as 1, 2, 3. Pull the release pin, lift the canopy nose and slide the canopy off the back of the helicopter.

Install Flight Battery

The Draganflyer X4-ES main power source is a removable, rechargeable, lithium-polymer battery. We put extra effort into designing a battery system that was safe, powerful and optimized to provide maximum flight performance.

The Draganflyer X4-ES helicopter system has been designed and precisely tuned for this battery. Only use Draganflyer X4-ES batteries with this aircraft or you will void your warranty.

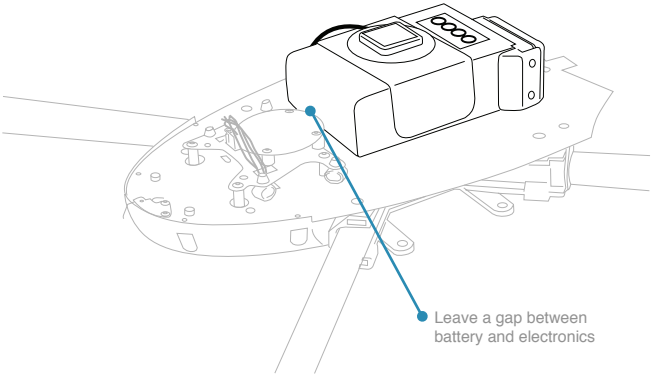


Special notice:

The helicopter autopilot expects to be flying with this battery. If you get the idea to try and use something else, please keep in mind the autopilot will "log" the error and you will void the system warranty for the life of the aircraft.

Battery position is important so please pay close attention to centering the battery under the GPS antenna flap. Also be very careful to make sure the battery doesn't make contact with the electronics directly in front of the battery. Double check and make sure you have a gap between battery and electronics.

To install, lift the GPS antenna mounting flap and place the battery on the helicopter deck plate.



Ensure the battery is not touching the GPS module located in front of the battery and double check to make certain the Velcro is secure.

Once the battery is seated, allow the GPS antenna flap to rest on top and wrap around the battery. Attach the flap to the Velcro mount along the side of the battery.

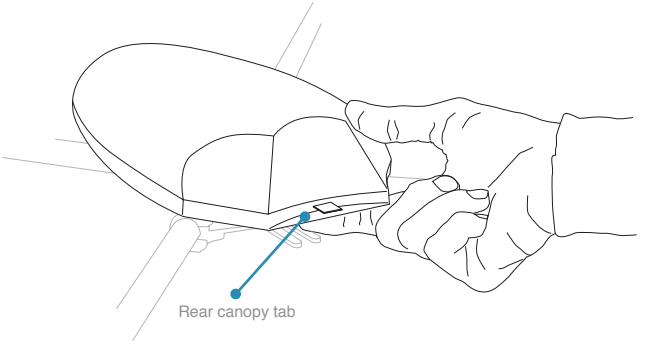
Before you're ready to fly, connect the main power cable from the helicopter to the battery. The connector is polarized so it will only connect in one orientation.

Special notice:

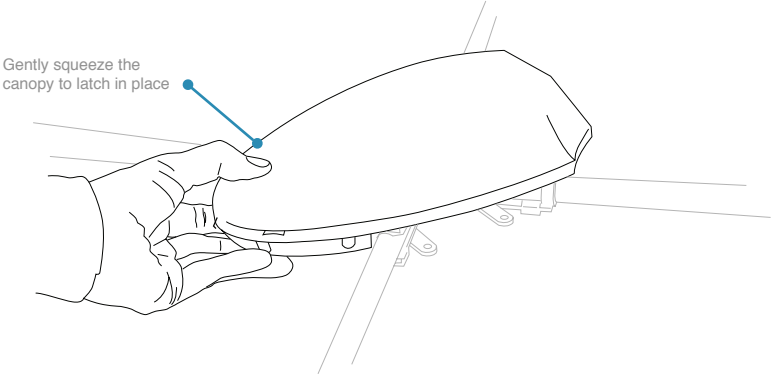
We know you're excited to get out flying but only connect the main power cable when you're ready to get up in the air. Leaving it plugged in for any length of time even when powered off, will slowly drain the battery.

Install Canopy

Installing the canopy is the reverse process. Start by inserting the canopy through the slot at the rear of the aircraft. Bring the front of the canopy forward and line-up the canopy pin with the helicopter latch assembly.



Gently squeeze the front of the canopy to “latch” in place. After latching be certain to test and make sure the canopy is securely fastened. Give the canopy a little tug and double check that it’s fastened before flying.

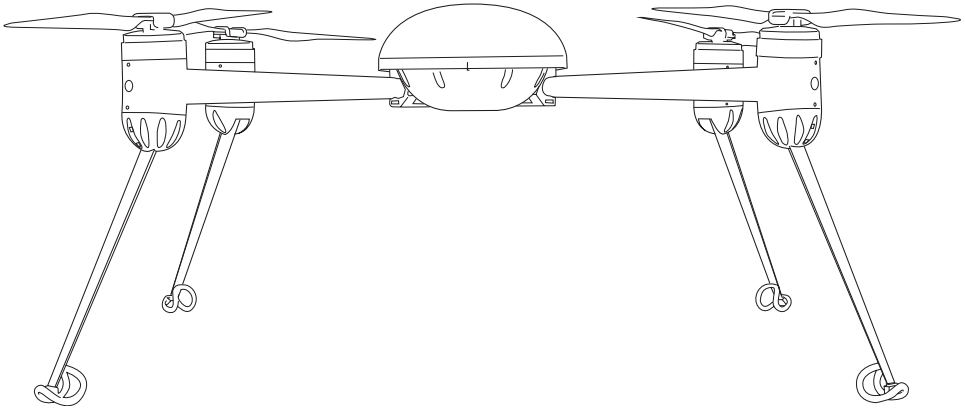


Helicopter assembled

The helicopter is now fully assembled and ready for flight. Even if you have been through our flight training program, we recommend that for your first few flights you fly in very light wind conditions and without a payload to test the system and get reacquainted with the aircraft.

In this manual we will discuss flying the helicopter and provide some tips and tricks to get the most from the aircraft. The actual mechanics of flying, such as details to arm the motors, engage motors, describe telemetry data and setting up live streaming video are discussed in the handheld Ground Control System (GCS) manual and also the standard Handheld Controller manual (HHC).

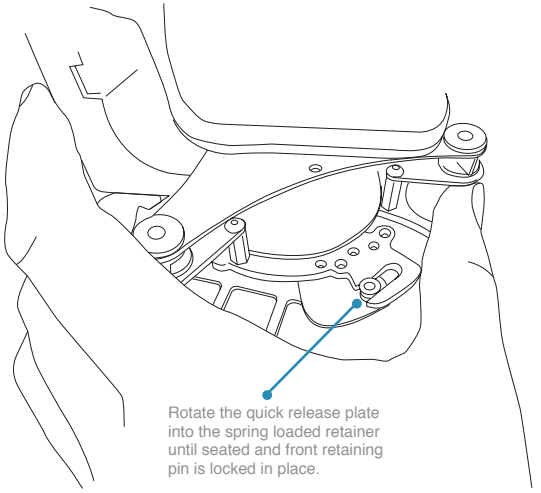
Most importantly we thank you for selecting the Draganfly product, hope you enjoy your flying, and believe the helicopter will prove to be an excellent aerial tool for you.



Install helicopter payload system

Draganfly offers several different payload options for the Draganflyer X4-ES system and each payload features an easy to use quick release system. All electrical connections pass through the quick release eliminating messy cables or the possibility of inadvertently not connecting something before take-off.

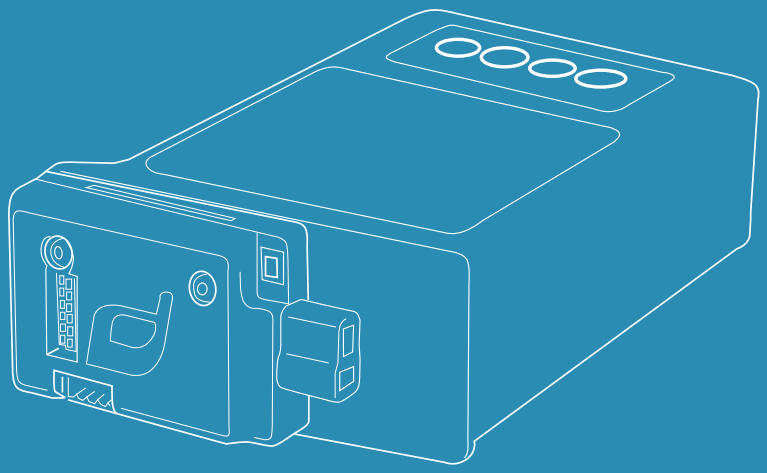
All payloads attach in the same fashion, using the quick release payload system. With the payload facing forward position and twist the quick release mount in place and make sure the locking pin is fully seated.



Special notice:

*The helicopter battery **MUST** be **disconnected** before you either plug-in or un-plug the the payload cable to the helicopter. Failure to do so, can damage both your payload or helicopter system.*

Chapter 2



Lithium Battery Safety Instructions and Warnings

Please read and fully understand all of the instructions and warnings below before using or charging your lithium polymer batteries. **Lithium Polymer (LiPo) batteries are volatile; improper use or failure to follow these instructions and warnings may result in fire, personal injury and/or damaged property.** Draganfly Innovations and its affiliates assume no liability for the improper use of this battery, or failure to comply with these instructions and warnings.

General Guidelines and Warnings

- Your batteries are not fully charged upon receiving them, the batteries must be charged before use.
- Use Lithium Polymer specific battery chargers only, such as the charger provided in your Draganflyer package. Use of any other type of charger can result in a fire which may result in personal injury and damage to property.
- Always keep batteries in a flame retardant container, such as the LiPo Sack included in your Draganflyer package during charging, storage and transportation.
- Never leave charging batteries unattended. When charging LiPo batteries you must constantly monitor the charging process and be there to react to any undesired results.
- If at any time the battery becomes swollen, immediately discontinue use or charging; disconnect the battery and place it in a safe observation area for 15 minutes. Charging a battery that has become swollen may result in fire.
- A safe observation area should be outdoors away from any property, vehicles or combustible material.

Do NOT leave a battery indoors for observation even if in a flame retardant container.

- Do not short the battery; shorts can cause fires. If you accidentally short the battery it must be placed in a safe observation area for 15 minutes. Be cautious of potential shorts and burns that may occur due to jewellery, such as rings or bracelets.
- Chemical reactions are not instantaneous; a battery that has been shorted or damaged will not ignite immediately; this may take-up to or longer than 15 minutes. Any battery that has been damaged or shorted, must be observed in a safe area for a minimum of 15 minutes.
- Any battery involved in a crash, whether deformed or not, must be placed in a safe observation area for 15 minutes.
- Discontinue use if the battery has been exposed to temperatures in excess of 170 F as indicated on the thermal strip attached to your battery.

Charging:

- Before charging visually inspect the battery and connectors for any damage, signs of swelling, or any other irregularities.
- Before charging, press the battery test button on your flight battery to check the status and voltage level. One or more of the status LED's should turn on and remain on while the button is held. Any other flashing pattern on the status LED's may indicate damage to the battery; please contact Draganfly Innovations Technical support.
- If you are unaware of the battery voltage, check the voltage of the battery before charging.
- Do not attempt to charge a battery with a voltage less than 3.3V per cell. For a flight battery and GCS this would be 13.3V and 9.9V for the standard style handheld controller battery.

- Never charge batteries unattended.
- Always keep the battery in a flame retardant container for charging.
- Allow the battery to cool to room temperature before charging.
- Do not attempt to charge multiple batteries in series.
- Do not attempt to charge multiple batteries in parallel.
- When selecting the cell count or voltage for charging, ensure to select the cell count and/or voltage that appears on the battery label. Selecting an incorrect cell count or voltage may result in a fire.
- Do not exceed the maximum charge rate current listed on the battery label.
- Always connect the balance cable between the battery and charger while charging or discharging.
- Only use a good quality charger rated for LiPo batteries, such as the charger including in your Draganflyer system. A low quality charger may damage the battery and result in fire.

Storage & Transport:

- Never ship or transport a damaged LiPo battery.
- Store batteries at room temperature between 4.5 degrees C (40 F) and 21 degrees C (70 F).
- Do not store batteries in a vehicle even if in a flame retardant container.
- Do not store or expose batteries to direct sunlight for extended periods of time.
- Do not store batteries near a source of heat.
- Exposing LiPo batteries to temperatures in excess of 65 degrees C (150 F) may cause permanent damages and premature deterioration to the battery.

- Do not expose batteries to temperatures in excess of 76 degrees C (170 F). Exposure for longer than 2 hours may cause fire.
- Before travelling with LiPo batteries always check with your airline for their policies and regulations regarding transportation of LiPo batteries.
- If shipping batteries, always discuss safe packaging and shipping procedures with the courier.

Disposal:

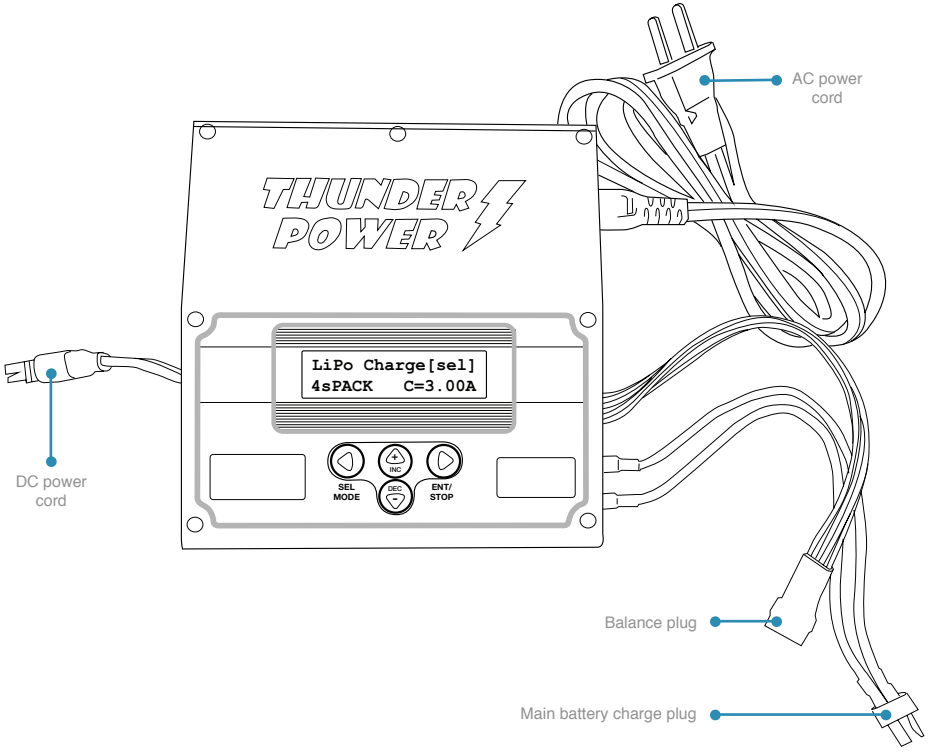
Lithium Polymer batteries that have lost 20% of their total capacity are considered worn and should be disposed of. Any worn or damaged battery should be immediately removed from service and disposed of. Never charge or use a worn or damaged battery.

To properly dispose of a LiPo battery fully submerge and soak the battery in saturated salt water for 48 hours. In most locations the battery can now be disposed of in household waste. Please check local waste management and recycling regulations for disposal of LiPo batteries. Do Not dispose of batteries in fire.

For assistance or additional information on Lithium Polymer batteries please contact Draganfly Innovations technical support.

Battery Charging System

Please fully read and understand the Lithium battery safety instructions and warnings section of this manual before using or charging your batteries. The operator assumes full responsibility for all risks associated with the use of this product.



Your Draganflyer X4-ES system comes equipped with a complete charging kit for the helicopter and controller batteries used with the X4-ES system. The charging system has been designed for ease of use, portability, safety, and convenience, to keep your systems charged and flying.

Included with the Draganflyer X4-ES charging system is:

1 – TP610ACDC single port battery charger (users manual included)
1 – 6 wire balancer cable
1 – 2 wire charging cable
1 – Fire retardant battery charging pouch

Setup and Operation

Your charger can be powered from a 110-240 volt AC wall outlet or an 11-18 volt DC power source such as a car battery. If using an AC wall outlet, remove the cable from the case, connect it to the power input of the charger, and plug the cable into an AC outlet.

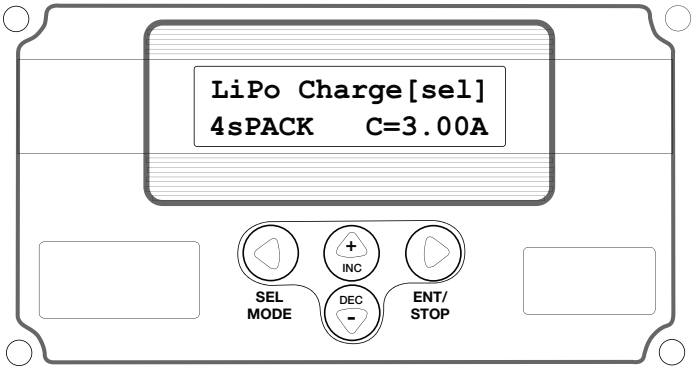
If you are using a 12V battery (car battery), connect the DC cable provided to the charger. After connecting the cable to the charger first, then connect the alligator clips to the terminals of your 12V battery (red clip to positive, black clip to negative). When power is applied, the charger will automatically turn on.

When the charger is powered on, the **+** and **–** buttons allow you to scroll up/down through menus before and during battery charging/discharging. These buttons also allow you to change values/settings for options after they have been selected (typically when flashing after pressing the ENTER button).
The **SEL/MODE** button functions only when you're not charging or discharging a battery. Pressing the MODE button will allow you to scroll between the three available modes:

- Charge/Discharge/Cycle/Storage Modes

- Setting Data Mode
- Data View Mode

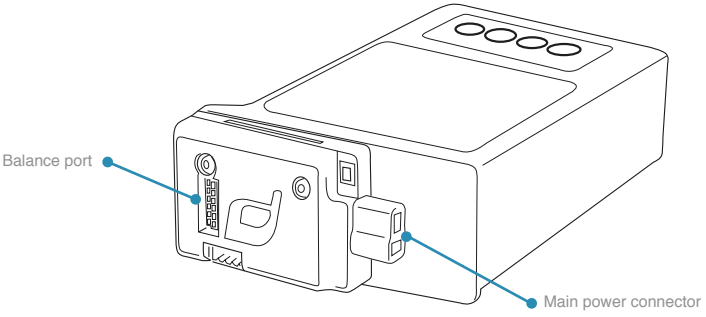
The **ENT/STOP** button allows you to select and validate values/settings for options that can be changed (using the +/– buttons to change) before and during charging/discharging. Pressing and holding the ENTER button also allows you to start and stop charging/discharging.



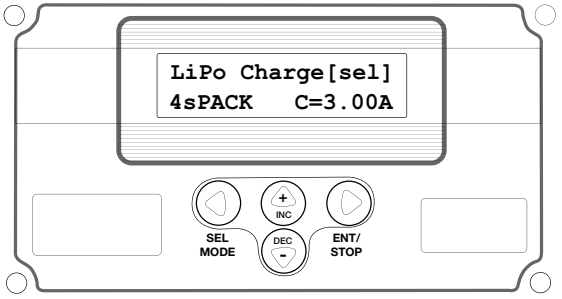
After powering on the charger by default it's set to 'Charge Mode' as illustrated above. Before shipping your system, your charger has been preset by our team for a 4 cell battery charging at 3 amps.

Charging helicopter batteries

Power on the charger and connect both the 2 wire charge cable and the 6 wire balancer cable to the battery. Both of these connectors are polarized so there is only one way to plug them in.



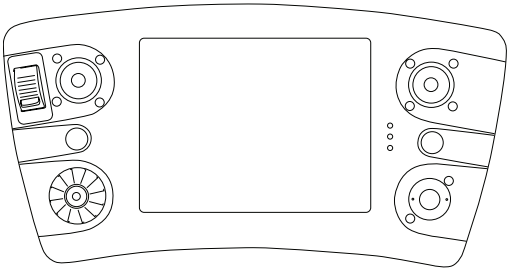
With the battery connected simply press and hold the **ENT/STOP** button for 3 seconds and the battery will start charging. At this default charger setting a full charge will take approximately 2 hours for a depleted battery. For a faster charge time, you can adjust the current(C=) up to 5.45A for the helicopter batteries only.



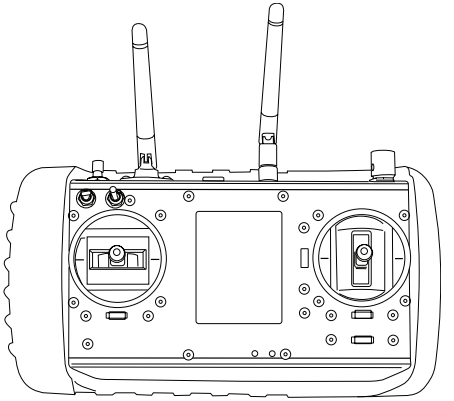
To increase the charging current repeatedly press the **ENT/STOP** button until C=3.00A is flashing on the display, then use the INC and DEC buttons to adjust the charging current to 5.45A. Press and hold the ENT/STOP button to begin charging. When the battery is fully charged the charger will display “F-” in the top left corner of the display screen.

Charging the Handheld Controller batteries

Included with your system is the handheld Ground Control System (GCS) and a standard handheld controller. The GCS is powered by a smaller capacity 4 Cell LiPo battery and the standard handheld controller is powered by a 3 Cell LiPo battery.



Handheld Ground Control System (GCS)
Charger setting = 4sPACK @1.7 Amps



Standard Handheld Controller (HHC)
Charger setting = 3sPACK @1.7 Amps

Charging these batteries is just as simple as charging your helicopter battery. The connections are the same using the balancer cable and main power charge plug but you always need to remember that when charging the standard controller, you need to change the charger cell count from 4 to 3, and reduce your charge current.

To make this change for the standard HHC, from the main charging screen you need to use the ENT/STOP, INC and DEC buttons. Using these controls adjust the charger to 3sPACK C=1.70A for the Standard controller.

Summary:

The battery charger provided has been preset at the factory to charge the helicopter LiPo battery pack. The charger connects to the batteries or controllers using two cables. One cable is a cell balancer cable, and the other is the main charge cable.

When charging the GCS you need a lower charge current setting and with the standard HHC, both the cell count and the charge current must be adjusted.

Standard and maximum charger settings:

- Helicopter battery pack = 4sPACK C=3.00A - *maximum current C=5.45A*
- Handheld GCS = 4sPACK C=1.70A - *maximum current C=2.70A*
- Handheld HHC - 3sPACK C=1.70A - *maximum current C=2.10A*

For additional instructions on your battery charger please refer to the TP610ACDC battery charger operator's manual included in your package

Things you need to know

Special notice:

You might think that we're exaggerating the issue but no, LiPo battery safety is something to be taken seriously. If you want to see examples of what can go wrong just search YouTube for LiPo fire examples. It's common to think "this will never happen to me" but that's why they call them accidents, so please take battery safety very seriously and here are some tips to consider:

1. When charging your batteries, always place them in a fire proof LiPo sack or case and be in the immediate area to listen for any errors detected by the charger during the charging process or if an explosion or fire takes place, you're there to deal with the situation.

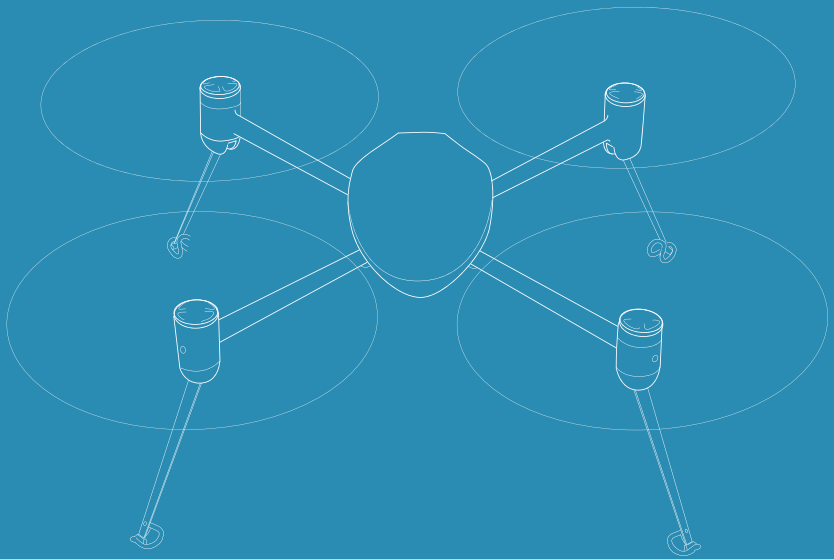
2. After charging is complete, always remove/disconnect both cables from the battery.

3. Keep your batteries out of direct sunlight or high heat conditions. For example don't set them on the dashboard of your car. You want to keep the batteries protected, cool and safe.

4. Some people think "more is better" but no, not with a LiPo battery. Please only charge the batteries at the prescribed cell count and current ratings. Trying to "over fill" a battery will result in damage.

5. If a battery is either old or damaged in a crash follow the proper battery disposal guidelines provided above, by submerging and soaking the battery in a salt water solution. And please, some people want to try and salvage the power connector from the battery or the electronics but no, you are placing yourself in serious risk of being injured.

Chapter 3



Your first flight

One of the great things about a helicopter is that you can fly it a quarter-of-an-inch at-a-time. And even better, you have the flexibility to fly in a wide open area, more restricted space, and if you have enough room, you can even fly indoors.

If you haven't taken the Draganfly certified flight training we highly encourage you to get the proper training. The two day, one-on-one training is designed to provide you with the essential knowledge, skills, and develop confidence to get you flying safely.

In situations where it's more cost effective to have a flight instructor fly out to your location versus bringing a team of three or four people to Canada, for an additional fee, Draganfly offers training worldwide at your location. If you have any questions about training, getting set-up for training, or having someone come out to your location, call Draganfly Innovations now.

Whether you've had training or not, for these first few flights we strongly suggest that you start out very slow, low, and just enjoy getting a feel for the aircraft and controls.

Pick a day with very calm or no wind conditions, and simply takeoff and land several times because honestly, if you can't comfortably takeoff and land, stop right there before you damage the aircraft and make arrangements for flight training.

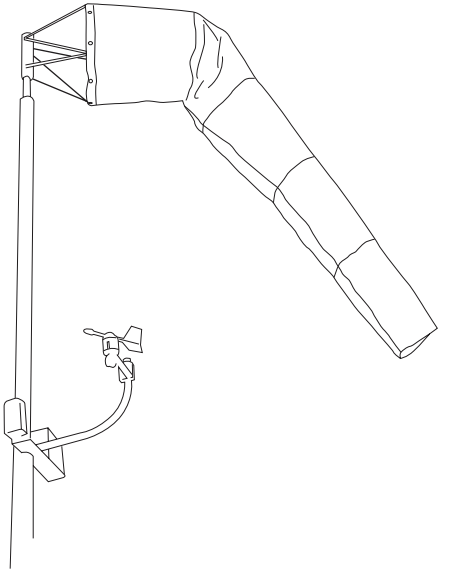
Items that will be covered in this section:

- **Understand the environment**
- **Helicopter pre-flight**
- **Helicopter training exercises**
- **Helicopter flight**

Understand the environment

If you think of your helicopter as if it were a balloon, you can quickly get an idea of the issues involved when flying in windy conditions. As you get more comfortable flying in wind, under certain circumstances letting your helicopter “float” with the wind is a good technique to shoot both smooth video or get crisp photos. And truly just like a balloon, on a strong windy day the helicopter will maintain it’s altitude and float across the sky.

The aircraft has it’s own limitations and based on skill level, combined with experience, different pilots have their own self imposed limitations. Quite often the helicopter will exceed personal limits, but care must be taken as you develop your flying skills.



And keep in mind there are different types of wind. Flying in straight line, steady winds like you find coming off a large lake or along the ocean are much easier to fly in than for example gusty, and changing winds, that you find in a canyon. Gusty and changing conditions are a challenge combined with strong up, and down drafts, that can make for an exciting day.

With experience you can comfortably fly in these conditions but please understand, this comes with experience. As the pilot in command, it’s your responsibility to determine if the weather conditions are suitable to execute the mission. Most people run into problems when they’re flying the aircraft in conditions beyond their skill level so it’s much better to stop the flight and wait for better

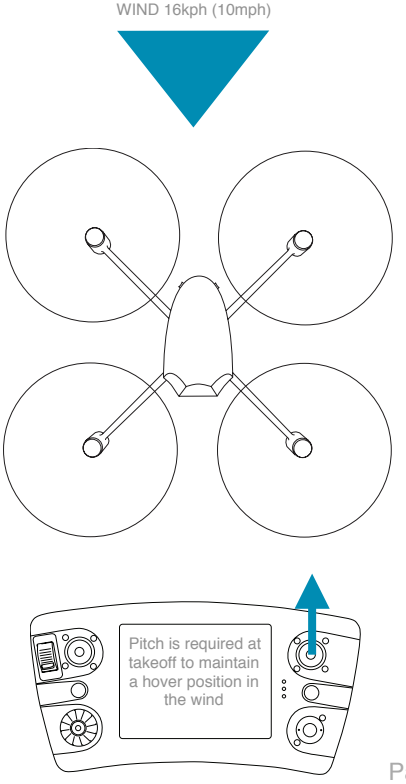
weather. Always keep in mind that no matter what the project, as the pilot you determine when it's safe to fly.

The helicopter and wind:

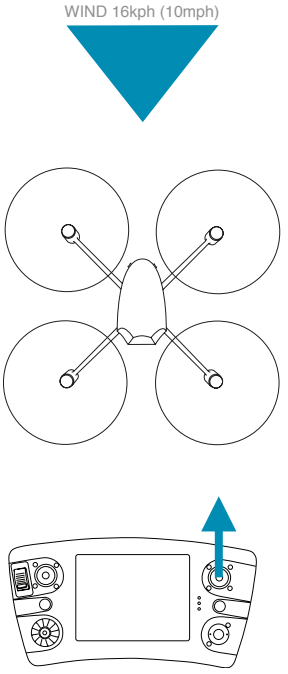
Although the helicopter system is actually very sophisticated there are times when you might think it's not. For example, let's assume we're flying in a 16kph (10mph) steady wind from the north. Before you takeoff, point the helicopter into the wind and because of your experience, you know that upon liftoff you'll need to "pitch" the aircraft forward to penetrate the wind and maintain a hover position. In this scenario the helicopter is flying forward at 16kph (10mph) to maintain 0mph ground speed in the hover.

As you're hovering in the wind, lets assume you gain a little altitude and if you were to "yaw" the helicopter, you know in advance of this maneuver, that you will need to apply pitch and roll to maintain the hover as the heading of the aircraft changes. As the pilot, when ever possible you want to mentally "stay ahead" of the aircraft.

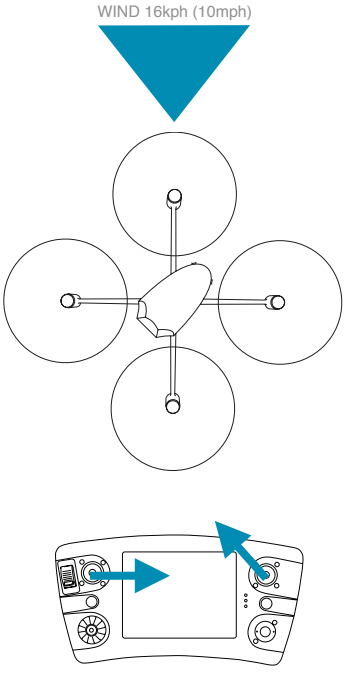
So in this example we're hovering at 3 meters altitude, the helicopter is pointed straight into the wind blowing at a steady speed of 16kph (10mph). To maintain a static hover position we must pitch the aircraft forward to essentially be flying at 16kph (10mph) into the wind. Under these



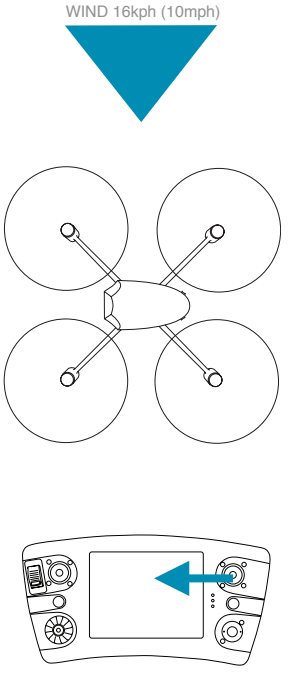
circumstances our ground speed is 0mph. If we begin to yaw the helicopter clockwise 90 degrees, we know that through the rotation of the aircraft, we'll need to introduce left roll, and reduce forward pitch, as the aircraft rotates to maintain the hover position.



To hover in this scenario requires pitch forward to match wind speed and maintain position



As you yaw clockwise you must introduce some roll during the aircraft rotation to maintain position



When helicopter approaches 90 degrees into the wind, pitch is reduced and roll increases because the helicopter is now flying sideways into the wind

When the helicopter reaches the 90 degree clockwise position, the nose of the aircraft is now pointing east. To maintain a steady hover, we'll need to control the aircraft with roll "left" because the helicopter is now broadside to the wind, flying sideways at 16kph (10mph).

At first this might sound complicated but with experience, flying the aircraft in different conditions is a learned skill that you'll develop.

GPS position hold and wind:

If you're out shooting photos or flying a mission there might be special occasions when you want to manually fly the helicopter to maintain a stationary hover as described above. However, most often, you will manually fly the aircraft into the desired position and assuming you have enough GPS satellites, switch the aircraft into a GPS position hold and let the autopilot do the work for you.

In the previous example we assumed you were manually flying the helicopter to maintain a stationary hover in a 16kph (10mph) wind. Let's use that same scenario again, but illustrate the benefits of using the GPS position hold feature.

Special notice:

With a GPS position hold in windy conditions the aircraft will move around and experience variations in altitude. Do not be alarmed; this is normal. If movement becomes excessive resume manual control of the aircraft.

At takeoff you want to mentally "stay ahead" of the aircraft and be prepared to "fly" the helicopter from the moment the skids leave the ground. Assume the helicopter is pointed straight into the wind so at takeoff, you will apply pitch as required to maintain a

hover. When you're happy the helicopter is behaving properly, you increase throttle to gain altitude and move pitch even more forward and fly away into the wind.

When you have flown the aircraft into the desired position, slow the aircraft into a good stable hovering position, double check your aircraft GPS position accuracy and switch the aircraft into a GPS position hold.

The helicopter will automatically hold its position, altitude and heading. If you wish to either reposition the aircraft or yaw the aircraft to change heading, you can do this even when the aircraft is in a GPS position hold. Clearly the primary benefit of the GPS position hold feature is to dramatically reduce the pilot involvement to maintain a hover position. This frees the pilot to focus more attention on getting the perfect photo, searching an area, or conducting the mission.

Forward flight & ballooning:

Because the helicopter is primarily flying in altitude hold mode you will notice a tendency for the aircraft to balloon (rise or fall) when coming to an abrupt stop. There is nothing wrong, nothing is broken; its only because altitude is controlled by the barometric sensor onboard the aircraft.

Special notice:

The aircraft will rise slightly or drop when making fast or abrupt changes to speed. You might also see altitude variations hovering in strong winds or even flying indoors on very windy days due to changes in air pressure.

When the aircraft is traveling fast and comes to an abrupt stop the barometric pressure in the body of the aircraft changes suddenly, causing the aircraft to either rise or dip.

When you're flying in strong gusty winds whether you're in a GPS position hold or flying manually, you will see some variation in altitude resulting from sudden pressure changes. Even flying indoors on very windy days you will see changes in altitude because of the varying air pressure inside the building.

It's important that you understand this and again we stress, that you need to "stay ahead" of the aircraft by anticipating what the aircraft will do when you're out flying.

Extreme temperature conditions:

The Draganflyer systems have been rigorously tested in extreme temperature conditions not just for a few weeks or months, but for years of operation. The aircraft perform well in these harsh conditions but when you're dealing with extremes, some precautions are required. First and foremost is the safety of the pilot, crew and people supporting the mission.

In regards to the helicopter, in extreme cold it's advised to keep your LiPo batteries warm before use. Once the batteries are under load they will start to generate their own heat but to get the best performance a warm (not hot) battery will deliver the type of power you are use to seeing.

In very hot temperatures it's important to keep the batteries out of direct sunlight and out of containers that might get very hot. For example if you place the batteries in a small black pelican style case, yes, they are out of direct sunlight but the air temperature inside the case may be very hot. Batteries exposed to temps in the range of 65 to 76 degrees C (150 - 170 degrees F) will be damaged.

When you are flying mid-day or late in the afternoon be aware of heat generated thermals. Unless a thermal is raising dust on the ground they are invisible to the naked eye. Along the outside edge of a thermal you often find very strong vertical down-draft wind currents. At the center of the thermal, very strong up-draft wind currents. Flying into a thermal is first detected by a sudden rise in helicopter rotor rpm as the autopilot tries to maintain altitude, while the aircraft is being pushed down by the strong wind along the outer edge of the thermal.

The best way to recover from this situation is to “fly out” of the thermal. When you hear or see this take place your first instinct is to increase throttle and assist the autopilot, but at the same time, try to turn away and fly forward out of the thermal.

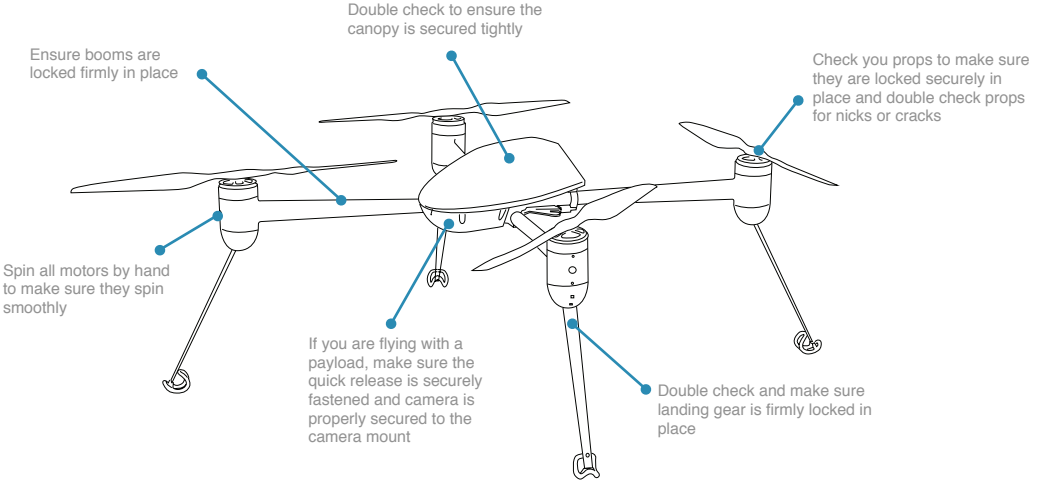
Does this happen very often? No, but we take the time to point this out because it’s one of the dangers flying in very hot conditions mid-day or later in the afternoon hours.

Special notice:

Thermals are invisible to the naked eye but most commonly occur on very hot days mid to late afternoon in flat areas and mixed terrain such as large asphalt parking lots and large open fields.

Helicopter preflight

Just like a real aircraft it is very important to pre-flight the Draganfly helicopter to make sure it's airworthy. We recommend a static on-the-ground pre-flight as illustrated below, and once you have taken off, we suggest a second flight check in a hover to make sure the aircraft and system are behaving properly. If you have any doubt, or suspect a problem, either cancel the mission or abort the flight until the problem is corrected.


Double check to ensure the canopy is secured tightly
Ensure booms are locked firmly in place
Check you props to make sure they are locked securely in place and double check props for nicks or cracks
Spin all motors by hand to make sure they spin smoothly
If you are flying with a payload, make sure the quick release is securely fastened and camera is properly secured to the camera mount
Double check and make sure landing gear is firmly locked in place

Draganflyer X4-ES System Pre-flight Check

Pre-flight system checks:

As illustrated above it's very important to pre-flight your aircraft before every flight. The system pre-flight is a quick but important procedure to follow even between flights. Never take anything for granted because more times than not, when you "assume" something is okay, that is the day you experience a problem.

Boom check

Check to make sure all four of the booms are locked in place and inspect each of the boom lock clips to make certain they are not cracked or showing signs of wear. If any of the clips are loose or damaged service the aircraft before flying.

Canopy check

Give the canopy a tug to make certain the nose of the canopy is locked firmly in place. Also inspect the rear slot to make sure the canopy is not cracked or torn. If you suspect a problem of any kind with the canopy do not fly the aircraft. For anyone that has experienced an in-flight canopy failure the results can be catastrophic.

Motor check

Rotate the prop on each motor slowly for one or two revolutions to check and make sure the motor is not binding. After a slow spin test, using your finger, give the prop a good fast spin and listen to the motor. Make sure to check all four motors and if you suspect a problem do not fly the aircraft and contact Draganfly.

Prop and prop installation check

Inspect the props for nicks, dents or cracks. If a prop is damaged either replace the prop or abort the flight. In regards to installation, the props are keyed so they can only be installed on the correct motor. Please, double check to make certain the props are mounted properly and firmly locked in place. At the same time inspect the prop latching mechanisms to make sure they are not worn or cracked. If you suspect a problem with the prop mounting system do not fly the aircraft.

Landing gear

Make certain each landing gear strut is extended and locked firmly in place. Also take this time to look them over carefully for any cracks or possible damage from a hard landing.

Aircraft payload

If you are flying with a payload, make certain all four of the payload quick release is firmly secured. Check the camera cables to make certain they do not bind as the camera is rotated in the mount and most importantly, make certain the camera mounting screw is secure.

Antenna orientation

This is also covered in the handheld controller manuals but please note, the strongest signal is achieved when the antenna is perpendicular to the aircraft. The weakest signal is off the “tip” of the antenna. Many people position the controller antennas sideways or on the GCS, pointing straight back off the controller.

Special notice:

Avoid pointing the handheld controller antennas directly at the aircraft. The signal will be degraded if the “tips” of the antennas are pointed at the aircraft. In the event of a datalink error, quickly move the orientation of the controller.

Control system check

Check to confirm the handheld controller is communicating with the aircraft and execute a few quick tests before getting the helicopter in the air. If you are not familiar with using either the standard Handheld Controller (HHC) or the handheld Ground Control System (GCS) refer to their specific manuals for in-depth details about their operation and control over the aircraft.

Variable aircraft and GCS settings:

And what we're referring to is aircraft settings that are most often used such as Navigation LED brightness, Altitude limit, GCS display brightness, GCS volume and your camera gimbal tilt angles. You want to double check these settings to make sure they are to your personal or mission specific preferences before getting in the air.

For example if you're conducting flight training indoors, setting the alitiude limit for the room will help prevent you from going into the ceiling, or flying for example a mission under a bridge or overhanging structure. Setting the limit will some buffer is a good idea to help prevent an accident.

The list below details a control system check using the handheld GCS:

- Power-on the GCS and power on the helicopter.
- The GCS will boot-up and the helicopter navigation lights will begin blinking
- Establish the wireless connection between the GCS and the aircraft.
- When connected, you will see aircraft telemetry displayed on the GCS.
- Because the motors are NOT ARMED, you can raise the throttle to test the GCS and helicopter data link.
- As the throttle is increased, the rear, white navigation lights will blink faster.
- If the payload is attached to the aircraft you can also tilt the camera and if the camera is powered on, take a photo using the shutter button on the handheld GCS.
- Take this time to also test the live streaming video link. With the camera powered on and the video network established, select the blue "play" arrow displayed on the video screen to enable streaming video.

Documentation and observers:

Log book entries

There's an old saying that your work isn't done until the paperwork is completed. Very few people enjoy paperwork but when it comes to operating an aircraft it's an important and valuable part of the job.

Included with your system is a Draganfly Systems Log Book and we highly recommend that you get into the habit of using it. The log book will detail flight times, any problems encountered, what batteries were flown and most importantly it's a good place to "match-up" comments about a flight with the flight data log recorded on the GCS or handheld controller. In the long run you will find the comments, history and information recoded in the log book to be of great value. Please use the log book.

Spotter or observer

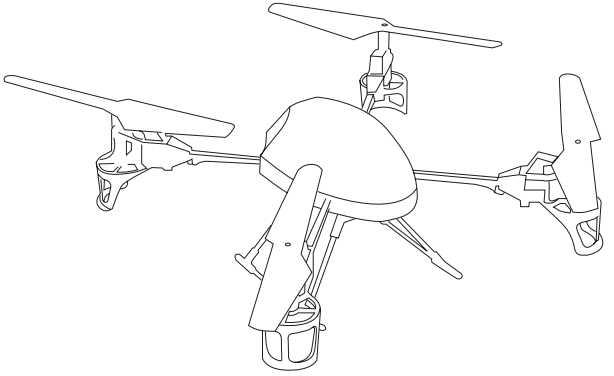
In some countries it's a requirement to have a trained spotter or observer working side-by-side with the pilot in command. Check with your local air space regulatory agency to understand the operating requirements in your country.

And whether it's a requirement or not, it's often a good idea to have a spotter or observer. The Draganfly aircraft camera controls can be wirelessly slaved to an observer handheld controller, and working together, the pilot and observer fly the mission much the same as what's done in full size aircraft.

Flight drills

After your flight training it's important to keep flying and hone your flying skills. We have seen instances where people have come back for the training of two, three or four pilots but they only have one helicopter system. Over time it works out that one or two people are the primary pilots and the others are not able to fly often. Because they are not flying on a regular basis they quickly loose their skills and confidence.

If you can't afford multiple Draganfly systems another approach is to compliment the helicopter system with an inexpensive aircraft like the "Lil' Draganflyer" that is provided along with your purchase. The Lil' Draganflyer is not as sophisticated but it serves as a good training platform to maintain your basic flight skills.



Understand that just "flying around" isn't practice. To really practice your skills you need to have clear goals and fly structured flight drills.

You were exposed to flight drills during your Draganfly training and we encourage you to continue running drills with the same course using small soccer or traffic cones flying either your Draganflyer X4-ES system or the Lil' Draganflyer pictured here.

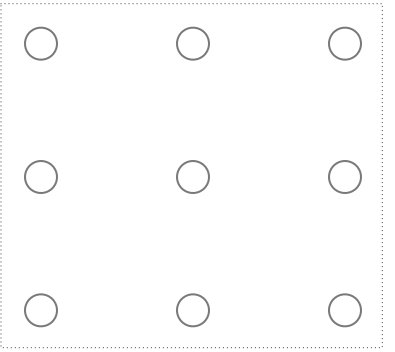
The following provides some suggested ideas for various flight drills and feel free to get creative and create some of your own. The important thing is to have clear goals and fly over a course of specific objects to provide some form of measure to determine how well you are doing. For example flying with the helicopter "nose-in" in a stationary hover

over a cone for one minute, rotate 90 degrees over the same cone and hold for one minute. With clear goals you will get results.

Training course:

A typical exercise course is created using 9 small traffic or soccer cones. The spacing between the cones varies on the size helicopter you are flying and the amount of space that you have available. With Draganfly training we will often use the training course for indoor flight instruction but the same exercises can be run outdoors on a much larger scale.

You can master the flight drills indoors and simply moving outdoors, creates an interesting challenge by simply having to deal with wind and the environment.



Typical training course layout using 9 cones

Flight exercise #1 - practice hover:

In this exercise you will simply takeoff, hover briefly and move out over a practice cone in a stationary hover.

- Keep the helicopter at chest height and hover over the center cone
- Hold hover position for one minute
- Remain over the center cone and yaw the helicopter 90 degrees
- Hold hover position for one minute
- Repeat this sequence for a complete 360 rotation over the center cone
- Return and land

Flight exercise #2 - practice roll:

During your Draganfly flight training you might recall the term “safety position”. The navigation LEDs on the Draganfly helicopters are very bright and at the rear of the aircraft you see two bright white LEDs. When both of these LEDs are pointed in your direction we call this the safety position because the helicopter heading is pointed in the same direction you are. This makes it easier to fly the aircraft because if you roll right, the aircraft moves right. You move pitch forward and the helicopter goes that direction.

The LED navigation lights on the Lil’ Draganflyer have been setup to match the Draganfly helicopter systems and whenever in doubt, always yaw the helicopter to the safety position and recovering from a disorientation problem will be much easier.

In this exercise you will fly in the safety position, meaning the rear of the aircraft will be pointed at you at all times.

- Keep the helicopter at chest height and hover over the center cone
- Hold hover position for thirty seconds
- Slide the helicopter sideways over the right middle cone
- Hold hover position for thirty seconds
- Slide the helicopter left back over the center cone
- Hold hover position for thirty seconds
- Slide the helicopter left over the left middle cone
- Hold hover position for thirty seconds
- Slide the helicopter right to get back over the center cone
- Hold hover position for thirty seconds
- Return and land

Flight exercise #3 - practice pitch:

This exercise is very similar to what we just did in exercise number two except we're primarily using pitch to change our position moving forward and backwards over the course.

- Keep the helicopter at chest height and hover over the center cone
- Hold hover position for thirty seconds
- Slide the helicopter forward over the far middle cone
- Hold hover position for thirty seconds
- Slide the helicopter left back over the center cone
- Hold hover position for thirty seconds
- Slide the helicopter back over the rear middle cone
- Hold hover position for thirty seconds
- Slide the helicopter forward to get back over the center cone
- Hold hover position for thirty seconds
- Return and land

Flight exercise #3 - practice pitch & roll:

It's now time to combine the two movements of pitch and roll to move around the training course. Do your best to maintain a constant altitude, take it slow and hold your hover position over the cones always flying in the safety position at all times.

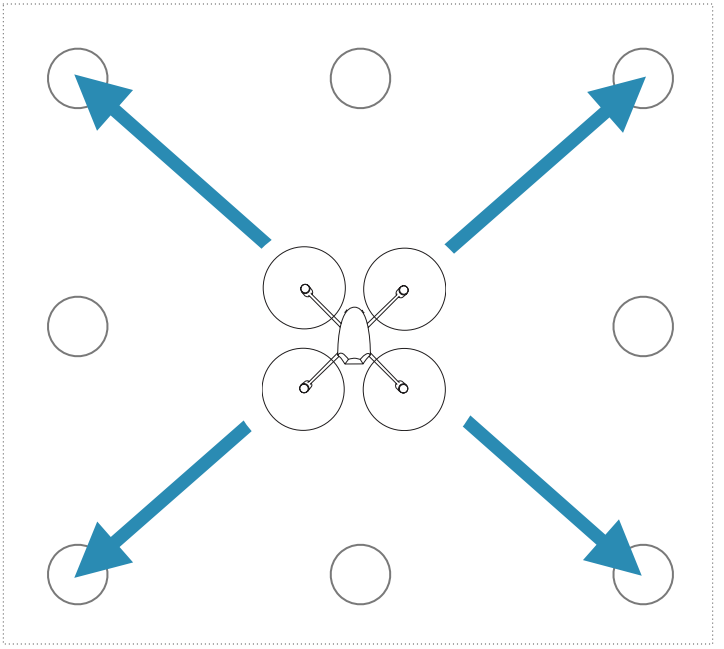
You can fly several different patterns in different directions so have fun with this but again, always hold your hover over each target cone. If you just go sailing past a cone you're flying the helicopter but you're not developing the skills required to control the helicopter. There is a big difference between just flying and really being in control.

- Keep the helicopter at chest height and hover over the center cone
- Hold hover position for thirty seconds
- Slide the helicopter forward over the far middle cone

- Hold hover position for thirty seconds
- Slide the helicopter left over the far left corner cone
- Hold hover position for thirty seconds
- Slide the helicopter back over the rear left corner cone
- Hold hover position for thirty seconds
- Slide the helicopter right to the rear far right cone
- Hold hover position for thirty seconds
- Slide the helicopter forward to the front far right cone
- Hold hover position for thirty seconds
- Slide the helicopter left over the far center cone
- Hold hover position for thirty seconds
- Slide the helicopter back over the center cone
- Hold hover position for thirty seconds
- Return and land

Flight exercise #4 - practice combined pitch & roll:

It's now time to keep the helicopter in a safety position but slide the helicopter on the diagonal from corner to corner. To accomplish this you will need to move the helicopter in both pitch and roll to create the diagonal movement. When you get to a corner, hold in a hover for 30 seconds and slide sideways to the next corner, then back on the diagonal.



Flight exercise #5 - 90 degrees out:

The exercises get a little more difficult as we move away from the safety position. The secret to maintain your orientation is to mentally place yourself inside the helicopter. If you can mentally see your surroundings from the perspective of the aircraft, you will

always know whether you need to pull roll or pitch one direction or the other, to maintain proper control.

Earlier in the manual we also discussed the concept of “staying ahead” of the aircraft. Remember you’re the one that’s in control. Much like an F1 driver, at the speeds they’re traveling the racers adjust their entry speed and start to turn, before they get to a corner. And as the pilot in command as best as you can, you need to mentally stay ahead of the aircraft.

For this exercise you will:

- fly out to the center cone and hover for 30 seconds
- yaw the helicopter 90 degrees clockwise and hover for 30 seconds over the cone
- yaw back to your safety position and hover for 30 seconds
- yaw 90 degrees counter clockwise and hover 30 seconds staying over the cone
- yaw back to your safety position and hover for 30 seconds
- return and land

Don’t make things anymore difficult than they are already. When you’re 90 degrees out either clockwise or counter clockwise and you want to get back to your safety position, always take the shortest path around. For example if the nose is 90 degrees clockwise pointing to the right, when you yaw back to your safety position, yaw counter clockwise. Why? Because if you were to continue yawing clockwise the helicopter requires another 270 degrees of rotation to regain your safety position. Remember to mentally stay ahead of the aircraft to anticipate your control inputs.

Flight exercise #6 - nose in:

Practice your 90 degree out flying quite a bit before you launch into nose-in flying. With the 90 degree out orientation have some fun and fly different patterns around the training course. And you might think it sounds silly but this can be mentally tiring so take a few breaks between these practice drills.

With nose-in flying you'll hear some people say "all the controls are backwards" but honestly don't fall into that trap. If you think this way, you will struggle with nose-in flight for the rest of your life. It's a mental leap to get yourself into the cockpit of that aircraft but you can do it. When you're out flying the helicopter in flight drills or a specific mission, imagine your surroundings from the viewpoint of the helicopter. If you can do this - flying nose-in is easy.

Take your time and work your way into it:

- fly out to the center cone and hover for 30 seconds
- yaw the helicopter 45 degrees clockwise and hover for 30 seconds over the cone
- yaw another 45 degrees clockwise and hover for 30 seconds over the cone
- yaw another 45 degrees clockwise and hover for 30 seconds over the cone
- yaw another 45 degrees clockwise and at this point the helicopter is nose-in, pointing straight at you. Hover over the center cone for 30 seconds
- yaw 180 degrees clockwise to your safety position and hover for 30 seconds
- return and land

Flight exercise #7 - combined skills:

By now you are very comfortable flying the aircraft in several different orientations so at this point try different exercises flying around the training course, taking time to stop, think, and hover over target cones.

And there is no such thing as style points, so if you're more comfortable turning your body or the controller to help with your control/orientation of the aircraft go ahead and do what works for you.

Enjoy your flying!

Helicopter flight

Leading up to this section we've talked about wind, temperature, basic pre-flight checks and training exercises. And as we've said before, the great thing about a helicopter is that we don't need to be going 56kph (35mph) to takeoff like an airplane; the helicopter can be flown a quarter-of-an-inch at a time, meaning you can take things at your own pace.

Before you take the helicopter up high or far away, you need to be in control at closer distances and lower altitudes so please take it low, and slow, to get started. The

illustration above is no joke, in operation at altitude, the helicopter gets very small very quickly.

In this section we'll cover flying the aircraft but keep in mind we won't be covering the detailed interaction with the handheld controllers. We assume that you have already looked over the start-up guide or handheld controller manuals and are familiar with connecting to the aircraft, arming the motors, engaging motors, engaging a GPS hold, and all the steps required to disarm, and disengage motors.

If you have no idea what we're talking about - stop now, and read over the GCS and handheld controller manuals.

Getting ready:

For your first flight it's a good idea to get out by yourself on a nice calm day. We've had many people contact us after either crashing or loosing their aircraft because they went out with a friend, or group of friends and instead of listening to common sense they were listening to their friends say ... how high will it go, how fast will it go and under peer pressure have done something they were not ready for. On the other hand, if you have a friend that get's you to slow down, to think things through, and error on the cautious side, they would be good to have by your side.

Safety

We talk about safety a lot because in the end, safety, and the safe operation of the aircraft is your responsibility. When the props are spinning and when the helicopter is in the air it can potentially hurt someone if it is flown into them or drops on them. Just like a real helicopter pilot that's scanning for places to set-down the helicopter in the event of an emergency, you need to be thinking about the people and property around and below the aircraft.

If you don't wear glasses, you and anyone near you should be wearing safety glasses. We provided you with one pair and if you need more, you can contact us or even better, purchase a couple pair locally to have on hand. Your eyes are a precious thing not easily repaired, so take all the steps required to protect them.

For your first flights if you're flying indoors make sure you have looked around the immediate area and along the ceiling, or roof area, to make sure there are no dangling strings, ropes or wires. Quite often people will hang a sign or something but when it comes time to take things down, the sign is gone but the cables or wires are still left hanging there.

If you're flying outdoors be aware of the wind and other people in the immediate area. Ideally you want the sun to your back, light or calm wind conditions and no people around.

Pre-flight

Go through the list of pre-flight items we discussed earlier and double check to make sure everything is in good working order. Run through the pre-flight to inspect:

- Boom check
- Canopy check
- Motor check
- Prop check
- Landing gear check
- Payload check
- Handheld controller battery
- Handheld controller antenna orientation
- Variable aircraft and GCS parameters check
- Control system check
- Fully charged helicopter flight battery

Look over the area

Whether you're indoors or outside look around the immediate area and think of places to easily set the aircraft down if needed. Also position any people or helpers behind you and instruct them to stay in one area.

If you're flying in a public area be aware that people will be curious and often in flight you'll be happily hovering the helicopter and all of a sudden someone will speak-up and ask you a question. You didn't even notice them approach you so it can be startling to find you have one or two people with you. Often people have several questions so it might just be better to bring the aircraft back, land, power down, answer their questions and before you know it they are gone. If you think it's dangerous to drive a car while talking on the phone it's even more dangerous to be distracted while flying.

Power on systems

Okay, time to power-up the helicopter and either the GCS or standard handheld controller.

- Power-on the GCS or standard controller
- Power-on the helicopter
- Position helicopter pointing into the wind if any
- Establish wireless connection between controller and helicopter
- Double check telemetry, battery health, signal strength and GPS satellites

It's time to takeoff

Assuming everything looks good it's time to takeoff. Step back away from the aircraft at least 3 to 5 meters (10 -15 feet) and if anyone is with you, make sure they have eye protection and are standing back behind you.

- Clearly announce that you are taking off
- Arm the motors
- Engage motors and ensure all props are spinning
- Scan the immediate area and double check your airspace to be clear
- Execute an automatic takeoff

When you execute an automatic takeoff the prop speed will increase and the helicopter will come up off the ground and settle at an altitude of about 1 meter or 3 feet. In this manual we have talked about “staying ahead” of the aircraft so keep in mind that as soon as the helicopter comes up you’re flying the helicopter. You will need to control

Special notice:

Understand when the aircraft comes up off the ground you are “Flying the aircraft”. The autopilot is controlling altitude during takeoff but you are controlling the pitch, roll and yaw to maintain a hover.

pitch, roll and yaw to maintain a stationary hover as the helicopter comes up to it’s target takeoff altitude.

During takeoff the throttle control is basically locked out until the aircraft reaches the target altitude. Often you’ll see the helicopter bounce a little or make a subtle movement when the time out expires and at that point you can increase altitude.

Get some altitude

By default the helicopter is flying in altitude hold mode. The autopilot uses barometric pressure to sense altitude so when you increase the throttle, what you’re really doing is requesting the autopilot to increase and set a new altitude.

Bring the aircraft up to a comfortable altitude somewhere around chest height and keep the aircraft in a steady hover to get a feel for the aircraft and conduct a secondary preflight to make sure all the controls are functioning properly.

Landing and disconnect

For this first flight let’s bring the aircraft down for a landing. Keep the helicopter in a stationary hover and slowly decrease altitude. As the skids near the ground the

helicopter will hit what's called ground effect, being buffered by the prop downwash and creating a cushion of air. At times it feels like you have to push the aircraft down to the ground so as you get close to the ground keep descending and when the skids touch, pull the throttle all the way back, and disengage motors.

- Decrease altitude
- When helicopter is down, pull throttle all the way straight back
- Disengage motors
- Disarm motors

Special notice:

When you land the aircraft and pull the throttle all the way back it's very important to pull straight back. If not you'll introduce a yaw command and the helicopter will attempt spinning around on the ground.

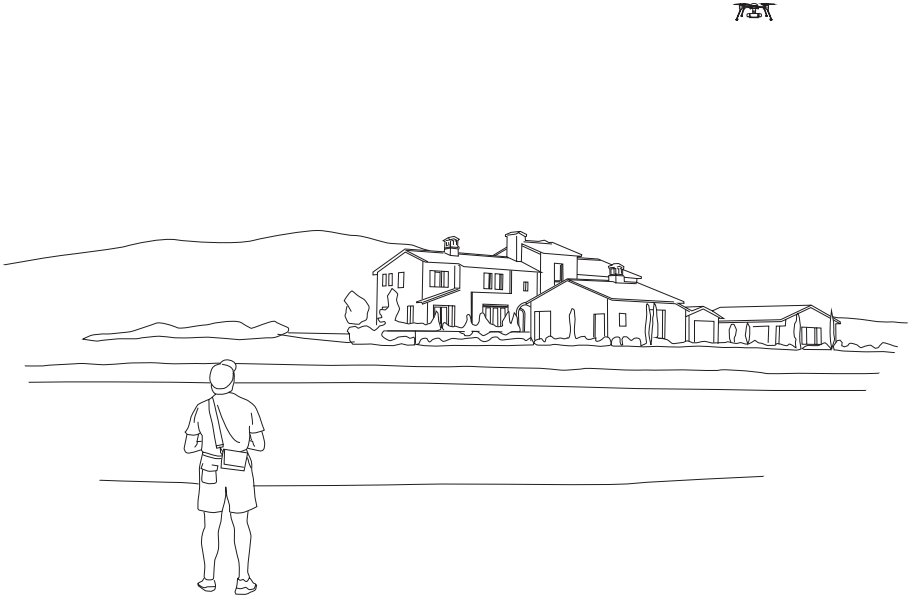
Also keep in mind the throttle needs to be pulled straight back and held for one second before you attempt to disengage motors. See your handheld controller manual for more details.

- Disconnect from aircraft
- Power down systems

Let's do some real flying:

In the beginning you need to run through flight drills with your helicopter and get really good at taking off and landing. If you can't takeoff and land or you're really nervous about it, you need to be comfortable doing this before you consider flying around higher or further away. So for now, let's assume you can easily fly all the flight drills and without even breaking a sweat, takeoff and land in varying environmental conditions.

In this scenario we'll fly up and away to shoot photos of the estate illustrated below. At



the same time, we'll pass along some tips, and tricks, in an attempt to circumvent problems some people have experienced. Notice the helicopter is quite a bit closer than the graphic at the beginning of this section. Until you build more confidence please keep the aircraft within 60 to 80 meters (197-263 feet) of your position and when ever possible, operate into the wind.

Pre-planning:

Before you just takeoff and go, set aside a few minutes to look at the area, get a feel for the weather, wind, and mentally rehearse the shots that you want to capture. In this scenario we are operating in a light breeze blowing from the direction of the estate and the sun is low in the horizon to our back.

Power-up and go:

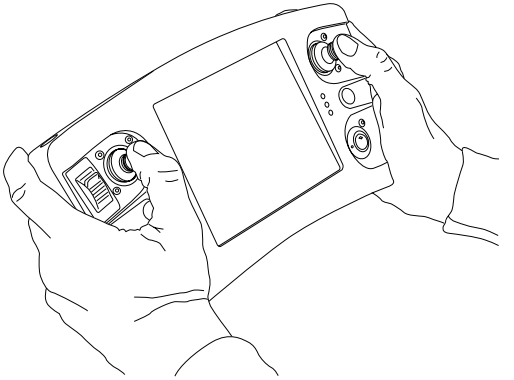
After a complete pre-flight and payload check, also check the airspace for any aircraft or low flying birds. Most birds will fly around the aircraft but the larger birds like geese are more unpredictable so just keep an eye open for them. Okay, let's power-up and takeoff:

- Power-on the GCS
- Power-on the helicopter
- Power-on the camera
- Position helicopter pointing into the wind
- Establish wireless connection between controller and helicopter
- Double check telemetry, battery health, signal strength and GPS satellites
- Enable streaming video to the handheld GCS
- Clearly announce that you are taking off
- Arm the motors
- Engage motors and ensure all props are spinning
- Scan the immediate area and double check the airspace to be clear
- Execute an automatic takeoff
- Hover and execute a secondary pre-flight control check
- Increase throttle and pitch forward in a steady climb at moderate speed

As you Increase throttle and pitch forward in a steady climb, the helicopter will be flying away from you at a moderate speed. For this flight stop climbing at an altitude of 30 meters (98 feet) and keep the helicopter no more than 60 to 80 meters (197-263 feet) away.

As you near your target destination slow the aircraft and double check your helicopter GPS position accuracy. If everything looks good, bring the aircraft to a stationary hover at 30 meters (98 feet) altitude and switch over to a GPS position hold.

At this point the autopilot onboard the aircraft is holding position and altitude for you at the given location. Be aware that although the autopilot is doing most of the work for you, your job is to make sure everything is going okay and be prepared to fly the aircraft at a moments notice. Often “listening” to the aircraft is as important as watching it and why? Because you will hear when the aircraft is fighting the wind or having a good/bad time up there so keep your ears open.



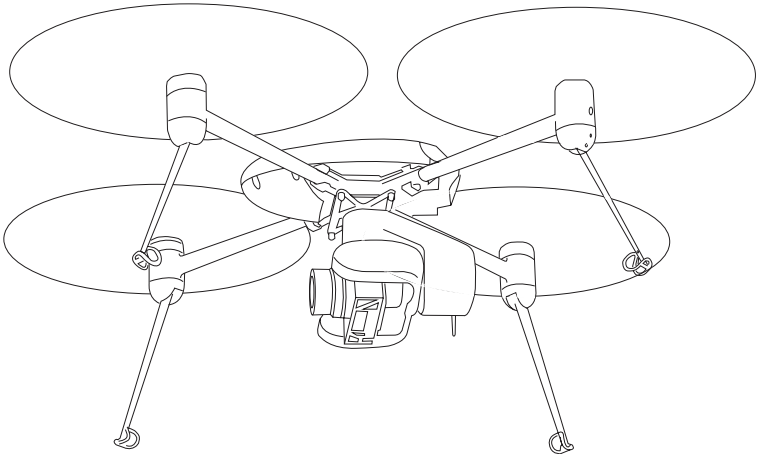
Toggle your GCS screen to full screen video and adjust the helicopter yaw position as well as the camera tilt position to frame the shots you want to capture. After taking a few photos you can either move the helicopter while it’s in GPS position hold, or release the GPS hold and fly to the next location; hover, and switch back over to GPS position hold.

So what’s the difference? Flying in a GPS position hold is slow because you’re basically overriding the GPS hold information. As a result, the helicopter moves at a much slower speed but for minor adjustments in position this works very well. As a rule of thumb if you plan to move a large distance, disengage the GPS hold and manually fly to the next location. For minor adjustments and position changes, stay locked in GPS hold mode and move the aircraft to the new location.

Remember that when you turn off the GPS position hold, you're flying the aircraft again so as we have said over and over, you want to "stay ahead" of the aircraft whenever possible.

In this scenario we're hovering in a wind so the instant the GPS hold is turned off the helicopter will start blowing back towards our location. If you want the helicopter to come back your way that's fine but, if you want to move in any other direction; to help get ahead of this, start by moving pitch forward so the helicopter begins penetrating the wind, then turn off the GPS position hold and fly to your new location.

At the new location slow to a steady hover and turn-on GPS position hold to frame and get more photos.



When you get your first battery low alarm, it's time to start bringing the helicopter back. In this scenario the helicopter is up-wind from your location. Yaw the helicopter to the safety position and when the GPS position hold is turned off, the wind will blow the helicopter back towards you.

When descending it's always best to "fly" the helicopter back down to the ground and what we mean is, let the helicopter keep moving as you descend so the helicopter is coming down through clean air.

If you're ever in a situation where you must descend vertically, you'll notice the helicopter will be fighting very turbulent conditions on the way down. This happens because the aircraft is coming down through it's own turbulence. To avoid this, bring the helicopter down at an angle, almost like the glide angle of an airplane.

In this scenario, announce to those around you that you're landing the aircraft. Turn off the GPS position hold and the wind will start blowing the helicopter back towards you. If it's going too slow, add some backwards pitch to adjust speed while at the same time reduce throttle and start descending. Try adjusting the speed and descent rate so the helicopter ends up at a low but comfortable altitude near your takeoff position. As the aircraft nears this spot, hover the helicopter in this position and prepare to land.

Keeping the aircraft in a steady hover, descend and make your landing by:

- Decrease altitude
- When helicopter is down, pull throttle all the way straight back
- Disengage motors
- Disarm motors
- Disconnect from aircraft
- Power down camera
- Power down systems

Aggressive flying skills:

After weeks and months of developing your flying skills, confidence builds and control inputs become reflex actions versus something you need to process and execute. Instinctive reflex reactions help you “stay ahead” of the aircraft and when this happens, you’re ready to tackle more aggressive flying skills.

The vast majority of the work you do with the aircraft will be the typical flight earlier described where you fly out, hover, shoot photos or gather data, and return. Simple up, out, hover and back work, but when the time comes to get up quickly, reposition quickly or shoot more interesting and creative video, the Draganflyer system is up to the task.

Drag racing:

Not only is this fun, but it’s a great flight training exercise to become familiar with flying your helicopter at higher speeds, high speed banking, and slowing to a stop.

Special notice:

Autopilot altitude is determined by barometric pressure. In strong winds or at high speeds the air pressure inside the bodywork will change causing momentary variations in altitude.

Take the helicopter to an open area so there is no concern about running into a tree, light pole or other obstacle. And as always you don’t want this to be a crowded area. If at all possible you want to be free of people, trees, poles or anything that will get in the way.

As we’ve mentioned altitude will vary with changes in air pressure so understand that you will need to “stay ahead” of the aircraft and control throttle throughout this maneuver.

For this first pass bring the aircraft up to about 10 or 15 meters (32-50 feet) and fly off to the right about 20 meters (66 feet) (lets call this an easterly direction) at normal speed. Hover the aircraft and yaw so the helicopter is pointed west. Lets ease into this by making a few runs at medium speed before a high speed pass so to get going, ease pitch forward and fly straight west past your position. After traveling another 20 meters (66 feet) past your position maintain your speed and introduce both yaw and roll to bank and turn left. As needed correct altitude throughout the flight.

The coordinated turn will require the use of all four controls. Maintain pitch forward, roll left and yaw left to bank the aircraft left through a wide 180 degree turn. Use throttle to maintain altitude.

As you fly back and around to your original start location, begin slowing the aircraft as you make your next left turn, slowing to a hover at your original start point. Repeat this pattern three or four times until you are very comfortable flying the circuit. During practice work on perfecting your coordinated turns.

With some practice now work on building speed. To get a quick start push pitch all the way forward and increase throttle at the same time to maintain altitude. As your speed builds bring throttle back to the center position and as you start your left hand turn, begin easing back on pitch, slowing the aircraft through the turn.

On the return leg of the circuit, travel at a moderate speed and when you enter the next left turn, slow the aircraft to a hover at your original start point.

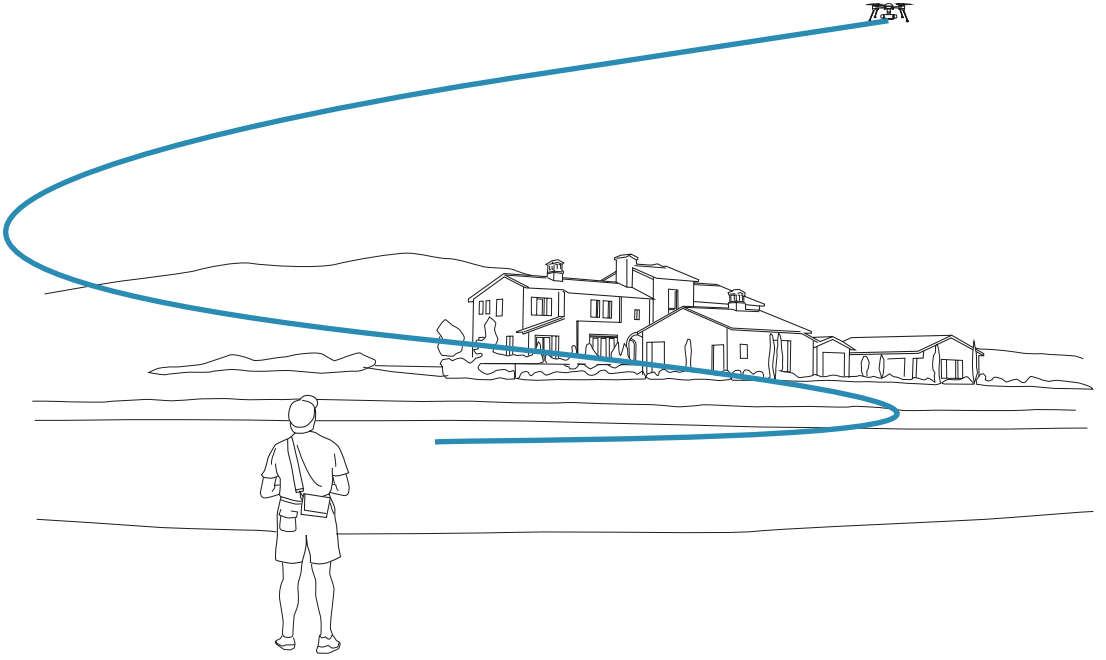
Have fun with this and pay attention to maintaing altitude and speed. practice the coordinated turns and always keep in mind that a good way to slow down the aircraft is a nice coordinated turn.

Quick stops:

In flight training and during routine practice, quick stops are something full size helicopter pilots practice often. It’s a safety maneuver and at the same time whether

you're flying a full size aircraft, RC helicopter or the Draganflyer, it's a fun, coordinated skill to execute.

In a full size aircraft the pilot will pull pitch back and drop collective pitch at the same time to maintain altitude and stop the aircraft. As airspeed drops the aircraft looses transitional lift and the pilot must quickly pull collective to maintain altitude. The same is true with a traditional RC helicopter and with the Draganflyer, you have the benefit of the autopilot system helping you through the process.



Using the same drag racing circuit we'll execute the same basic pattern but instead of making a left hand turn, we'll stop, hover, yaw 180, and come back the opposite direction at a high rate of speed. At the end of the run execute a quick stop, hover, yaw 180 and race back the other way to repeat the exercise.

To get started it's very much the same as what we described in the drag racing section but as you near the end, you will execute a quick stop by quickly pulling back on pitch. This control input will suddenly, and abruptly, pitch the nose of the aircraft up and "stop" the aircraft. It's just like slamming on the brakes but be prepared on the throttle to help the autopilot maintain altitude.

Like all the exercises we have described work your way up to this maneuver starting slow and building up your speed.

Rapid ascent and descent:

If you push throttle all the way up, you're commanding the autopilot to increase altitude at the maximum programmed climb rate of 2 meters (6.5 feet)/second. And the same is true for the descent, pulled all the way back the helicopter will drop at about 2m/s (6.5 f/s).

Execute your preflight, auto takeoff and move the helicopter out about 6 meters (20 feet) in front of you. From a hover increase throttle all the way and the helicopter will climb quickly. At 30 meters (98 feet) slow the ascent and bring the throttle to the center position, hovering at that altitude.

It's a matter of personal preference. If you descend vertically at a fast descent rate the helicopter will get caught up in it's own turbulence so it's preferred to fly forward in a turn to quickly descend and land the aircraft. So lets give it a try.

From your hovering position at 30 or 40 meters (98-140 feet) fly the aircraft forward at a good speed and execute a coordinated turn either clockwise or counter clockwise around your location and while maintaining your speed and the coordinated turn pull

throttle all the way back to the maximum descent rate. What you're doing is "flying the aircraft down" through clean air making for an amazing and impressive descent.
As the aircraft gets lower start slowing the aircraft, reducing your descent rate by bringing throttle back up towards the center position until you are in a stable hover at chest height out in front of your starting position.

Professional approach & landing:
Earlier we had you flying the helicopter back from your photo taking position in the safety position, essentially flying backwards to your landing spot but with more practice and the skills just described you have the option to bring the aircraft back with style.

When it's time to head back for a landing, point the helicopter nose in flying forward to your landing location. As the helicopter approaches a good way to slow and descend is a nice coordinated turn. As the aircraft approaches start reducing throttle, and in this example we're flying counter clockwise around our position with a coordinated turn, constantly descending and slowing through the turn. Slow to a hover at chest height near your landing spot and land the aircraft.

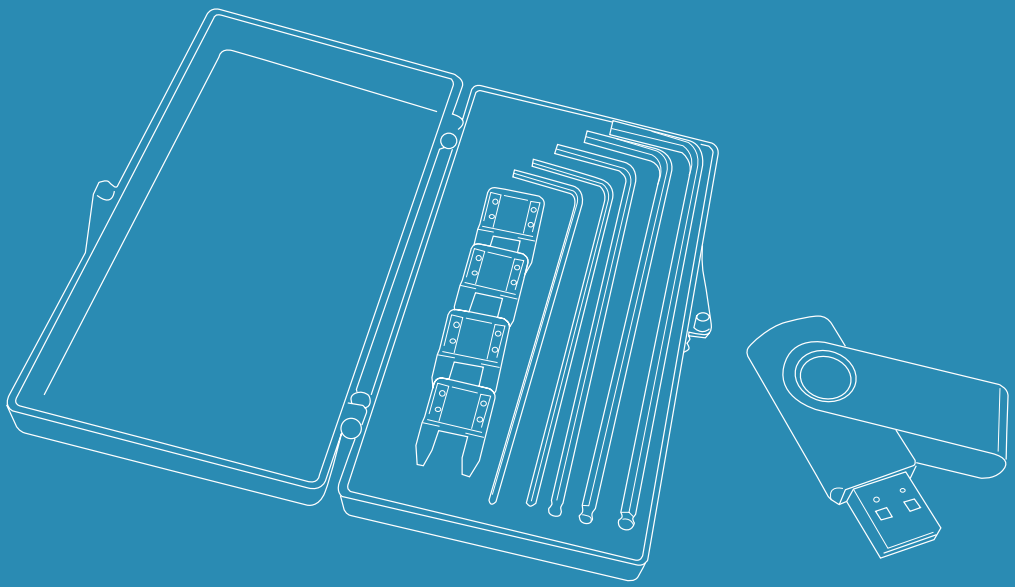
Summary:

We covered a lot of material in this section from:

- environmental concerns like wind and temperature
- flight training exercises
- your first flight
- basic mission flights
- more aggressive flying and skill development

We hope you found this document useful, informative, and very possibly it has given you some ideas and insight to help get the most out of the complete helicopter system. The Draganflyer X4-ES system is a precision tool designed to provide you with a new aerial perspective and new creative edge to your work.

Chapter 4



Maintenance

The Draganflyer X4-ES features a direct drive system requiring minimal maintenance as compared to a tradition style helicopter with servo linkages, gears, drive shafts, clutch, rotor head, swash plate, tail rotor and pitch change mechanisms.

However, as the pilot in command, in addition to the health of your batteries, you are responsible for the mechanical integrity of the aircraft, so it's a good idea to inspect the aircraft on a regular basis for any wear or damage. Should any component on the helicopter or support equipment show signs of fatigue or damage, immediately discontinue use until the component has been properly replaced.

To help ensure safe operation and keep your Draganflyer running at its best we recommend that you inspect or service the aircraft at the following intervals listed below.

Every Flying Session:

- Inspect folding mechanisms and all joints for damage or wear
- Inspect motors for rough motion
- Inspect all props and mounting clips for damage
- Inspect batteries for damage or puffing
- Inspect payload attach points and cable
- Check to ensure the hand held controller is recording a log file.
- Clean all components with a soft damp cloth or compressed air

Every 3 months:

- Check for software updates
- Check mounting bolts on rotor mounts to ensure they are tight
- Perform a motor test and inspect for rough sounding motors
- Cycle flight batteries

- Inspect canopy mounting latch and slot for tears or cracks

Every Year or 300 flight hours:

Please contact Draganfly Innovations Customer Service Department for assistance with the following service requirements.

- Inspect and clean all electrical connections
- Inspect all crimps and solder connections on movable components
- Inspect all moveable components for wear
- Recalibration of magnetometer and main circuit board
- Inspect motor assemblies and replace all that are worn
- Inspect all fasteners, linkages and joints
- inspect all rubber mounting brackets
- Cycle and test flight batteries
- Cycle and test hand held controller battery
- Cycle and test base station battery
- Check for software updates

Every 600 flight hours:

Congratulations for hitting the 600 hour mark. Please contact Draganfly Innovations Customer Service Department for assistance to overhaul or replace all motor assemblies.

Troubleshooting

Problem: **When I try to engage motors, the motors won't start.**

Possible cause:

- The handheld controller might not be connected to the aircraft
- You overlooked first "arming" the motors
- The aircraft "hold mode switch" must be in the center "altitude hold" position

Solution: Power-on the aircraft and the handheld Ground Control System (GCS). When the aircraft completes it's power-up self test the navigation LEDs will be blinking. When the GCS boots-up, it will beep and also display the home screen.

The GCS is always "looking" for an aircraft to connect with and lists all Draganflyer aircraft it detected in the status window area.

When the GCS detects the aircraft, the aircraft identification (ID) will be listed in the status window. To connect, simply "click" the helicopter ID and the GCS will establish the wireless datalink connection.

When the connection is made you'll hear the audio confirmation and see the aircraft telemetry displayed on the GCS home screen.

Make sure the "aircraft hold mode" switch is in the center position and arm the motors. When the motors are armed you'll receive an audio confirmation and the helicopter LEDs will stop blinking and remain on.

Depressing the "engage motor" switch will start the motors.

If after following these instructions and your motors will not engage, contact Draganfly Innovations by phone or e-mail for more assistance.

Problem: **The aircraft will not power-on... nothing happens.**

Possible cause:

- Make certain the helicopter battery is connected
- Check the battery charge by depressing the battery selftest button
- Possibly one of the motor fuses have blown

Solution: At the rear of the X4-ES helicopter, under the deck plate, you will see four fuses. Assuming your battery was connected and charged it's time to check the fuses so to begin, first start by "disconnecting" the power cable to helicopter battery.

With the battery disconnected, remove and inspect each fuse. Often you can visually inspect a fuse but the better test, is to check them with a continuity tester, or ohm meter to make sure they are good.

If all the fuses test good and you still can not power on the helicopter after reinstalling the fuses and battery, contact Draganfly Innovations by phone or e-mail for more assistance.

Problem: **In flight the helicopter requires excessive stick input to remain level and hover in one position.**

Possible cause:

- You're manually trying to hover in a strong wind
- Pitch or Roll trim set to an excessive value
- Damaged rotors or motor
- Insecure circuit board or battery is hitting electronics assembly

Solution: There are some quick and simple things you can check to address this problem. If you're flying in a strong wind, you'll be more than aware of the conditions and if you have access to a large indoor area, or a place protected from the wind double check to see if you really have a problem.

Another possibility is that you or someone has adjusted either the pitch or roll trim to an excessive position. To check this, reset and make sure your trim tabs are in the "zero"

position. If you're not familiar with what we're describing here, look in your GCS manual to get more information on setting pitch and roll trim.

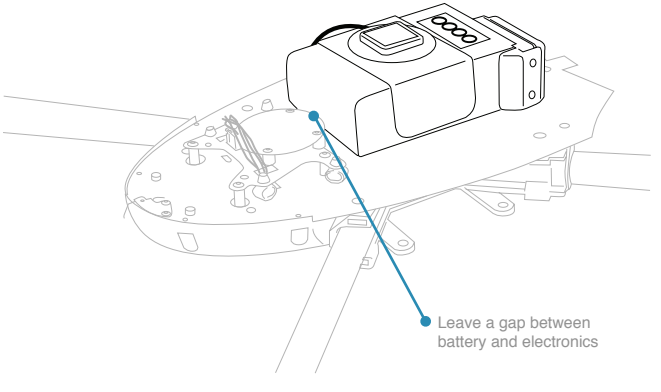
Assuming this is not a wind or trim problem, also inspect your motors and props for any damage. The props are visually inspected as well as running your hands over the leading edge of the props trying to feel for any damage.

To test the motors, use your finger and simply give the prop/motor a good spin. The motors should all spin and sound about the same. If you see or detect a problem contact Draganfly to get more information.

If none of these ideas have solved your problem another possibility is that your flight battery is touching or pushing on the electronics directly in front of it. When you install the battery, you need to take care and leave a small gap or space, between the battery and electronics.

Also inspect the electronics mounting to make sure the circuit board assembly has not come loose, or that one of the vibration isolators haven't broken.

If none of these suggestions have helped, contact Draganfly Innovations by phone or e-mail for more assistance.



Problem: **From the time it takes off to the time I get it back on the ground the helicopter is spinning in circles.**

Possible cause:

- Yaw trim adjusted to an extreme limit
- Aircraft calibration error

Solution: If the problem is the same using either the GCS or the Standard Handheld Controller (HHC) there is a serious calibration problem with the aircraft and you'll need to contact Draganfly.

The GCS doesn't have a yaw trim adjustment so if the helicopter flies fine with the GCS and not the HHC, you need to check the HHC yaw trim value. If you're not familiar with adjusting the trim values, reference the HHC user manual and set it to zero.

Problem: **My flight times are getting shorter and shorter?**

Possible cause:

- Old or degraded flight batteries
- Overheated motors

Solution: The health of your flight batteries is a critical factor in determining flight time. To make sure you don't have a problem with your motors or aircraft, try flying with a new, fully charged battery. If your flight time is restored take note of how long you flew and how much capacity (in mAh) was used to recharge the battery. Write the down the flight time and charge value.

Fully charge a suspect battery and conduct a flight test. If the flight time is considerably shorter write down the time and when recharging the battery, note the capacity (in mAh) required to recharge the battery. Write these values down and contact Draganfly to get more information.

Problem: **I wait and wait, but I'm not getting a GPS position lock.**

Possible cause:

- Poor satellite conditions
- You are indoors
- You are possibly surrounded by large buildings or trees

Solution: Even out in wide open spaces on a nice sunny warm day, there will be instances when it takes several minutes to get a solid GPS position lock. The great thing about the Draganfly system is that the helicopter can be easily flown manually under GPS denied conditions. That's great but you want to use the GPS...

The GPS receiver needs to "see the sky" and as a result, you typically will not receive a GPS position lock if you are indoors, under a canopy of trees, in a forested area or a dense urban area with tall skyscrapers.

If you are in what we would consider "ideal" conditions and if after 5 - 7 minutes you're not getting satellites there is more than likely a problem with the GPS receiver. Contact Draganfly to get more information.

Problem: **When I snap one of the booms in place it just doesn't feel right and seems loose.**

Possible cause:

- Worn boom latch clip
- Damaged airframe

Solution: DO NOT fly the aircraft until this problem is resolved; closely inspect the boom latch for cracks or damage. If that's the only boom affected and the others are solid, more than likely the latch clip of the suspect boom is at fault or the boom hinge assembly is broken. Contact Draganfly to discuss this further and have the aircraft serviced.

Do not fly until this problem is resolved.

Problem: **It feels like a motor is loose.**

Possible cause:

- Motor mount screws missing
- Internal motor mounting has come loose
- Broken motor mount
- Damaged airframe

Solution: DO NOT fly the aircraft until this problem is resolved. The motors are held in place with five small set screws around the top lip of a motor pod. The motor pods are molded as one piece making up a helicopter boom.

Take a look and make sure all five screws are in place and also inspect to make sure the motor pod is not cracked around the screw holes.

If the motor is physically coming out of the motor pod this is a serious problem but if you can grab a prop and push the motor around a little - some movement is normal because internally the motors are mounted on rubber bushings. Test all motors and if they all feel the same you more than likely don't have a problem.

If there is any doubt, contact Draganfly to get more information.

Problem: **I'm in a GPS position hold but the helicopter is wandering all over the place.**

Possible cause:

- Poor GPS position lock
- Heavy, gusty, wind conditions

Solution: In windy conditions it is normal to have the helicopter move around a little and it will also vary in altitude. When you are in a position hold take note of the GPS accuracy number on the GCS and write it down. If you're seeing numbers like 1.6 or 2 the helicopter will be moving anywhere in the range of 2 meters (6.5 feet) either direction. If you're seeing numbers like .6 this is a much tighter GPS position lock and the aircraft should stay in position within a meter either direction.

Understand that in windy conditions the helicopter will be moving around within limits determined by the GPS position accuracy.

If your GPS numbers look good and you're still having problems, contact Draganfly for more information.

Contacting Draganfly Service:

When you contact Draganfly Innovations for service before making the phone call or sending the e-mail, it's best to gather up and write down some information. Please be prepared to tell the support specialist your:

- Account ID number
- Company or customer name
- Helicopter firmware revision level
- GCS firmware and DraganView software revision level
- Standard handheld controller firmware revision level

Product support:

Phone: 1-800-979-9794
International: 1-306-955-9907
e-mail: support@draganfly.com

Technical Specifications

Airframe Dimensions: (assembled)

- Diameter (rotor span): 106cm (42”)
- Width: 87cm (34”)
- Length: 87cm (34”)
- Height: 28cm (11”)
- Landing Gear footprint: 63.5cm x 63.5cm (25” x25”)

Airframe Dimensions: (folded with rotors)

- Width: 35cm (14”)
- Length: 70cm (28”)
- Height: 25cm (10”)

Data Link RF Communications:

- Link Type: 2.4GHz two way
- Helicopter Antenna: Wired Whip Antenna
- Controller Antenna: Omni Directional Whip
- Transmission Power: North America: 50mW (+18dBm) International: 10mW (+10dBM)
- RF Data Rate: 250kbps
- Receiver sensitivity: -100dBm
- Transmission Technique: DSSS (Direct Sequence Spread Spectrum)
- Frequency Band: 2.400 – 2.4835 GHz
- Certification: CE, FCC, IC, ETSI
- Data Link Channel Selection: Automatic (13 channels)

Video Link RF Communications:

- Link Type: 5.8GHz two way
- Transmitter Antenna: Wired Whip Antenna
- Receiver Antenna: Internal flat patch & external Omni directional whip
- Transmission Power: 19dBm
- RF Data Rate: 54 Mbps
- Transmission Technique: 802.11n
- Frequency Band: 5.180GHz - 5.825GHz
- Certification: FCC, IC, CE

Sensors:

- 3 Solid State MEMS (Micro-Electro-Mechanical Systems) Gyros
- 3 Solid State MEMS (Micro-Electro-Mechanical Systems) Accelerometers
- 3 axis Magnetometer (Magnetoresistive Sensors)
- 1 Barometric Pressure Sensor

GPS:

- GPS Used For: Position Hold, Location & Velocity Data
- Maximum Satellites Tracked Simultaneously: 16
- Position Update Rate: 5 Hz
- GPS Antenna: Ceramic Patch

Flight Data Recorder:

- Standard Flight Data recorded on GCS controller, saved to internal memory
- Advanced Flight Data recorded to a 2Gb micro SD memory card in the helicopter.

Weight and Payload:

- Helicopter Weight (with battery): 1,800g (64oz)
- Payload Capability: 800g (26oz)

- Maximum Gross Takeoff Weight: 2,550g (90oz)

Flight Characteristics:

- Climb Rate: 2m/s (6.5ft/s)
- Descent Rate: 2m/s (6.5ft/s)
- Turn Rate: 90°/second
- Maximum Speed: 50km/h (30mph)
- Minimum Speed: 0km/h (0mph)
- Launch Type: VTOL (Vertical Take Off and Landing)
- Flight Time: Approximately 20 minutes
- Sound at 1m (3.28ft):72dB
- Sound at 3m (9.84ft):62dB

Rotor Blades:

- Four opposing rotation fixed pitch
- Rotor blade material: molded carbon fiber
- Diameter: 40cm (16”)

Motors:

- 4 electric brushless motors
- Direct drive (one motor per rotor)

Optional Camera Attachments:

- 16.7MP (Mega-Pixel) Digital Still Camera with active stabilized camera mount and remote shutter control
- Thermal FLIR (Forward Looking Infra-Red) Camera with Remote Controlled Tilt & onboard digital video recorder
- Low Light (0.0001 lux) Dusk/Dawn Black & White Video Camera with Remote Controlled Tilt & onboard digital video recorder

Navigation Lights:

- Type: 1 Watt LED Variable Brightness Emitters
- Luminous Flux at Full Brightness: 40lm
- Purpose: Helicopter Orientation Confirmation
- Visible Condition Range: Full Darkness to Direct Sunlight
- Standard Aircraft Colors: Left Front - Red, Right Front - Green, Rear - dual White

Rechargeable Flight Battery:

- Cell Chemistry: Lithium Polymer
- Voltage: 14.8V nominal
- Capacity: 5400mAh
- Connectors: Integrated Balance and Power
- Recharge Time: 1 hour (after typical flight).

Materials:

- Carbon Fiber
- Glass filled injection molded Nylon
- ABS and Nylon plastic
- Aluminum, nylon and stainless steel fasteners
- RoHS compliant

Operating Requirements:

- Recommended Pre-Use Temperature: 10° to 35°C (50° to 95°F)
- Maximum Environmental Operating Temperature: -25° to 38°C (-13° to 100°F)
- Relative Humidity: 0% to 90% Non-condensing
- Maximum Wind speed: Varies based on payload and mission

Contact Information

Draganfly Innovations Inc.

Product support:

Phone: 1-800-979-9794
International: 1-306-955-9907
e-mail: support@draganfly.com

Sales information:

Phone: 1-800-979-9794
International: 1-306-955-9907
Online: www.draganfly.com
e-mail: sales@draganfly.com

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